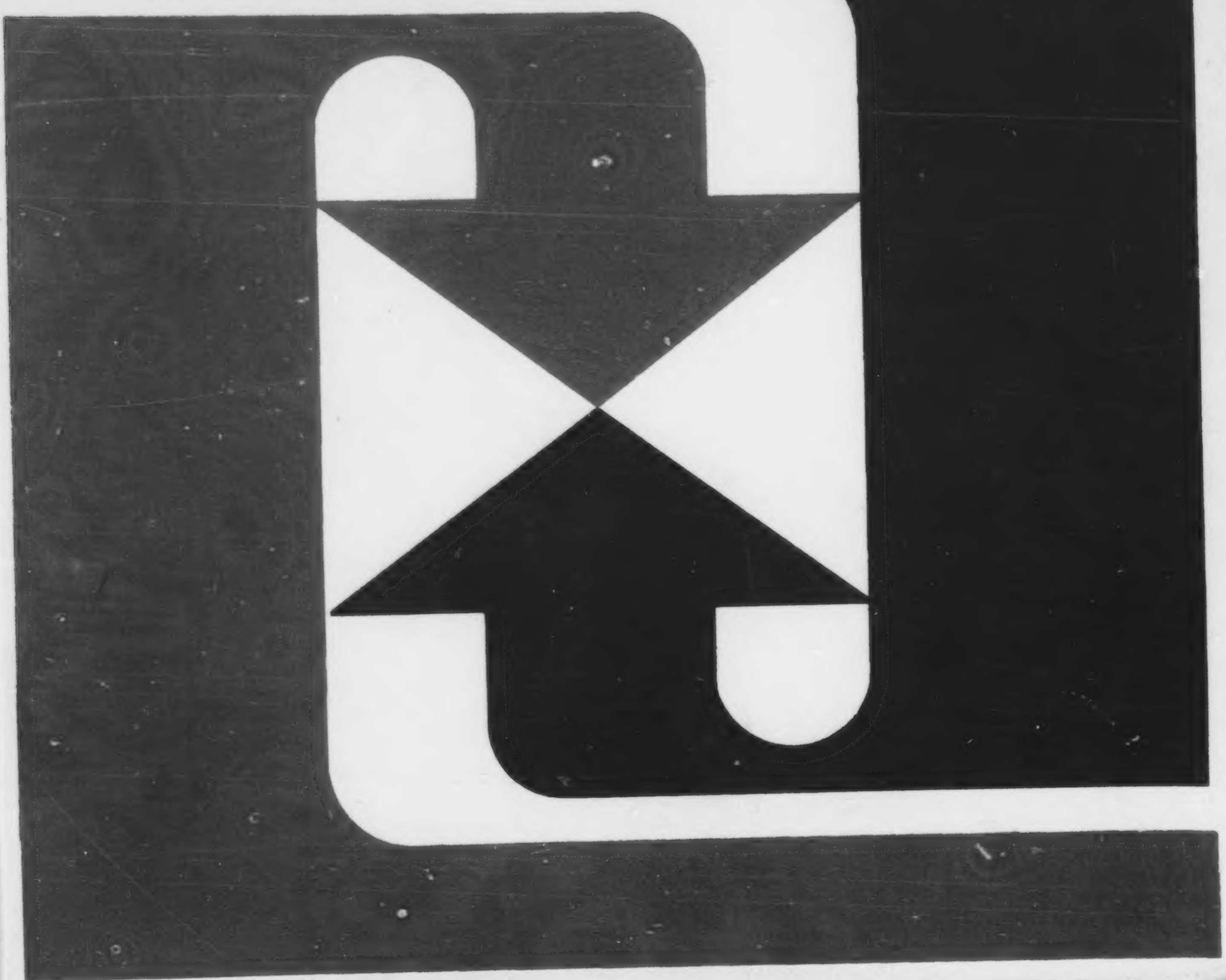
MANUAL
ON
UNIFORM
TRAFFIC
CONTROL
DEVICES

FOR STREETS AND HIGHWAYS



D6.1d—1986

MANUAL
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FOR STREETS AND HIGHWAYS
1978

REVISION NO. 4

MARCH 1986

U.S. Department of Transportation
Federal Highway Administration

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TO: Holders of the 1978 Manual on Uniform Traffic Control Devices (MUTCD)

SUBJECT: Transmittal of Revision Number 4 of the MUTCD

The attached page changes to the 1978 MUTCD incorporate the amendments adopted by the Federal Highway Administration for inclusion therein. The changes were published in the following two *Federal Registers*:

(1) *Federal Register*, Volume 49, Number 192, dated October 2, 1984. The effective date of these amendments is December 31, 1984.

(2) *Federal Register*, Volume 50, Number 49, dated March 13, 1985. The effective date of these amendments is July 22, 1985.

This package includes a complete listing of Official MUTCD Rulings on Interpretations, Changes, and Experimentation made since issuance of the 1978 MUTCD. The previous listing of Official Rulings furnished with Revision Number 3, should be discarded in its entirety. Most rulings are effective on the data indicated opposite each ruling. However, some of the rulings include a compliance date by which that revision is to be fully implemented.

This package also includes an updated listing of MUTCD-related documents (Section 1A-7) and an updated listing of the National Committee on Uniform Traffic Control Devices sponsoring organizations.

Part III - Markings, Part IV - Signals, and Part VII - School Areas have been reprinted in their entirety. The text for Part VI - Construction and Maintenance, has also been reprinted in its entirety except for pages 6B-3 through 6B-12.

Any questions or comments concerning this revision or the MUTCD in general, should be sent to: Traffic Control Systems Division (HTO-20), Office of Traffic Operations, Federal Highway Administration, Washington, D.C. 20590.

D6.1—1978
D6.1—1984

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES

FOR STREETS AND HIGHWAYS
1978

REVISION NO. 3

SEPTEMBER 1984

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Federal Highway Administration

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(Supersedes D6.1–1971)

[Revisions to this Manual will be published periodically and are available from the Government Printing Office]

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TO: Holders of the 1978 Manual on Uniform Traffic Control
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SUBJECT: Transmittal of Revision Number 3 of the 1978 Manual
on Uniform Traffic Control Devices (MUTCD)

The attached page changes to the 1978 MUTCD incorporate the amendments adopted by the Federal Highway Administrator for inclusion therein. The changes were published in the Federal Register, Volume 48, Number 233, December 2, 1983, and became effective March 1, 1984.

This package includes a complete listing of Official MUTCD Rulings on Interpretations, Changes, and Experimentations made since issuance of the 1978 MUTCD. The previous listing of Official Rulings, furnished with Revision Number 2, should be discarded in its entirety. Most rulings are effective on the action date indicated opposite each ruling. However, some of the rulings include a compliance date by which that revision is to be fully implemented.

Any questions or comments concerning this revision or the MUTCD in general should be sent to: Traffic Control Systems Division (HTO-20), Office of Traffic Operations, Federal Highway Administration, Washington, D.C. 20590.

D6.1—1978
D6.1-1983

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REVISION NO. 2

DECEMBER 1983

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TO: Holders of the 1978 Manual on Uniform Traffic Control
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SUBJECT: Transmittal of Revision Number 2 of the 1983 Manual on
         Uniform Traffic Control Devices (MUTCD).

The attached pen and ink changes and page changes to the 1978 MUTCD incorporate the amendments adopted by the Federal Highway Administrator for inclusion therein. The changes were published in the Federal Register, Volume 48, Number 6, January 10, 1983, and became effective February 9, 1983.

This package includes a complete listing of Official MUTCD Rulings on Interpretations, Changes, and Experimentations made since issuance of the 1978 MUTCD. The previous listing of Official Rulings, furnished with Revision Number 1, should be discarded in its entirety. Most rulings are effective on the action date indicated opposite each ruling. However, some of the rulings include a compliance date by which that revision is to be fully implemented.

Any questions or comments concerning this revision or the MUTCD in general should be sent to: Traffic Control Systems Division (HTO-20), Office of Traffic Operations, Federal Highway Administration, Washington, D.C. 20590.

1983 EDITION - TRAFFIC CONTROL DEVICES HANDBOOK: Now available is the 1983 edition of the Traffic Control Devices Handbook (TCDH). The TCDH was developed to serve as an operational guide to supplement the Manual on Uniform Traffic Control Devices. While the TCDH contains recommended practices; engineering analysis and judgment should pervail in operational use. The contents of the TCDH do not constitute Federal Highway Administration policy nor national standards. The TCDH may be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The stock number is 050-001-00270-1 and the cost is $20 per copy or $1,500 per 100 copies to a single address.

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MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES

SUPERSEDED TITLE PAGE

FOR STREETS AND HIGHWAYS

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THIS EDITION DEVELOPED WITH THE COOPERATION OF
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MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES

FOR STREETS AND HIGHWAYS

Includes revisions 1-4

THIS EDITION DEVELOPED WITH THE COOPERATION OF
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U.S. Department of Transportation
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MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES

INTRODUCTION

Traffic control devices are all signs, signals, markings, and devices placed on, over, or adjacent to a street or highway by authority of a public body or official having jurisdiction to regulate, warn, or guide traffic.

The need for high uniform standards was recognized long ago. The American Association of State Highway and Transportation Officials published a manual for rural highways in 1927 and the National Conference on Street and Highway Safety published a manual for urban streets in 1929. But the necessity for unification of the standards applicable to different classes of road and street systems was obvious. To meet this need, a joint committee of the American Association of State Highway and Transportation Officials and the National Conference on Street and Highway Safety developed, and published in 1935, the original edition of this Manual of Uniform Traffic Control Devices. That committee, though changed from time to time in organization and personnel, has been in continuous existence and has been responsible for periodic revisions of the Manual, including this 1978 edition. In 1972, the Committee's name was formally changed to the National Advisory Committee (NAC) on Uniform Traffic Control Devices.

In the preparation of this Manual, the National Advisory Committee has utilized its Executive Committee and its Technical Subcommittees and draws on the talents of persons in addition to its formal membership in the conduct of its work. All National Advisory Committee members and members of its subcommittees serve on a voluntary basis giving freely of their time in the Manual deliberations, both in technical subcommittee work in their home areas and at the formal meetings held each year.

Staff for the National Advisory Committee is provided by the Federal Highway Administration, Department of Transportation. Correspondence should be addressed to the Executive Director, National Advisory Committee on Uniform Traffic Control Devices, Federal Highway Administration, Washington, D.C. 20590.

1978 Edition

Approved Revisions

This Edition of the Manual incorporates all revisions which have been approved through official rulings issued by the Federal Highway Administrator. Most of these rulings have been previously published and widely distributed in addenda to the 1971 Manual ("MUTCD Official Rulings on Requests," Volumes I-VIII).

Symbols and Additions

This edition of the Manual continues the trend set in the previous editions toward broader use of symbols as alternatives to word messages. Also, several additions have been made to the Manual as a result of reorganization of material and the necessity for expanded treatment of some topics. These additions are traffic controls for railroad grade crossings (Part VIII) and bicycle facilities (Part IX).

Implementation

It is expected that basic uniformity will be obtained in the visible features and functioning of traffic control devices on all highways in accordance with this Manual. Implementation of standards contained in this Manual on all highways open to public travel will be governed by Federal directive.

PART I
General Provisions

Part I. GENERAL PROVISIONS

1A-1 Purpose of Traffic Control Devices

The purpose of traffic control devices and warrants for their use is to help insure highway safety by providing for the orderly and predictable movement of all traffic, motorized and non-motorized, throughout the national highway transportation system, and to provide such guidance and warnings as are needed to insure the safe and informed operation of individual elements of the traffic stream.

Traffic control devices are used to direct and assist vehicle operators in the guidance and navigation tasks required to traverse safely any facility open to public travel.

Guide and information signs are solely for the purpose of traffic control and are not an advertising medium.

1A-2 Requirements of Traffic Control Devices

This Manual sets forth the basic principles that govern the design and usage of traffic control devices. These principles appear throughout the text in discussions of the devices to which they apply, and it is important that they be given primary consideration in the selection and application of each device.

The Manual presents traffic control device standards for all streets and highways open to public travel regardless of type or class or the governmental agency having jurisdiction. Where a device is intended for limited application only, or for a specific system, the text specifies the restrictions on its use.

To be effective, a traffic control device should meet five basic requirements. They are:

1. Fulfill a need.
2. Command attention.
3. Convey a clear, simple meaning.
4. Command respect of road users.
5. Give adequate time for proper response.

In the case of regulatory devices, the actions required of vehicle operators and pedestrians should be specified by State statute, or by local ordinance or resolution which are consistent with national standards. Uniformity of meaning is vital to effective traffic control devices. Meanings ascribed to devices in this Manual are in general accord with the Uniform Vehicle Code of the National Committee on Uniform Traffic Laws and Ordinances, which is the nationally recognized standard in this area.

Five basic considerations are employed to insure that these requirements are met. They are: design, placement, operation, maintenance, and uniformity.

Design of the device should assure that such features as size, contrast, colors, shape, composition, and lighting or reflectorization are combined to draw attention to the device; that shape, size, colors, and simplicity of message combine to produce a clear meaning; that legibility and size combine with placement to permit adequate time for response; and that uniformity, size, legibility and reasonableness of the regulation combine to command respect. In the design of a device, minor modifications of the specified design elements may be necessary, provided that the essential appearance characteristics are met.

Placement of the device should assure that it is within the cone of vision of the viewer so that it will command attention; that it is positioned with respect to the point, object, or situation to which it applies to aid in conveying the proper meaning; and that its location, combined with suitable legibility, is such that a driver traveling at normal speed has adequate time to make the proper response.

Operation or application should assure that appropriate devices and related equipment are installed to meet the traffic requirements at a given location. Furthermore, the device must be placed and operated in a uniform and consistent manner to assure, to the extent possible, that vehicle operators can be expected to properly respond to the device, based on their previous exposure to similar traffic control situations.

Maintenance of devices should be to high standards to assure that legibility is retained, that the device is visible, and that it is removed if no longer needed. Clean, legible, properly mounted devices in good working condition command the respect of vehicle operators and pedestrians. In addition to physical maintenance, functional maintenance is required to adjust needed traffic control devices to current conditions and to remove unnecessary traffic control devices. The fact that a device is in good physical condition should not be a basis for deferring needed replacement or change. Furthermore, carelessly executed maintenance can destroy the value of a group of devices by throwing them out of balance. For example, replacement of a sign in a group or series by one that is disproportionately large may tend to deprecate others in the vicinity.

Uniformity of traffic control devices simplifies the task of the road user because it aids in recognition and understanding. It aids road users, police officers, and traffic courts by giving everyone the same interpretation. It aids public highway and traffic officials through economy in manufacture, installation, maintenance and administration.

Simply stated, uniformity means treating similar situations in the same way. The use of uniform traffic control devices does not, in itself, constitute uniformity. A standard device used where it is not appropriate is as objectionable as a nonstandard device; in fact, this may be worse, in that such misuse may result in disrespect at those locations where the device is needed.

1A-3 Responsibility for Traffic Control Devices

The responsibility for traffic control devices rests with a multitude of governmental jurisdictions. In virtually all States, traffic control devices placed and maintained by State and local officials are required by statute to conform to a State Manual which shall be in substantial conformance with this Manual. Many Federal agencies have regulations requiring standards in conformance with this Manual for their control device applications.

The Uniform Vehicle Code has the following provision in Section 15-104 for the adoption of a uniform manual:

> "The (State Highway Agency) shall adopt a manual and specifications for a uniform system of traffic-control devices consistent with the provisions of this act for use upon highways within this State. Such uniform system shall correlate with and so far as possible conform to the system set forth in the most recent edition of the Manual on Uniform Traffic Control Devices for Streets and Highways, and other standards issued or endorsed by the Federal Highway Administrator."

Under authority granted by Congress in 1966, the Secretary of Transportation has decreed that traffic control devices on all streets and highways in each State shall be in substantial conformance with standards issued or endorsed by the Federal Highway Administrator.

1A-3.1 Placement Authority

Traffic control devices shall be palced only by the authority of a public body or official having jurisdiction, for the purpose of regulating, warning, or guiding traffic. No traffic control device or its support shall bear any advertizing or commercial message, or any other message that is not essential to traffic control.

Any unauthorized sign placed on the highway right-of-way by a private organization or individual constitutes a public nuisance. All unofficial and nonessential signs should be removed.

With proper authority being given, construction contractors and public utility companies are permitted to erect construction and maintenance signs at work sites to protect the public, equipment, and workmen, provided that such signs conform to the standards of this Manual.

All traffic islands shall be installed by the authority of the public body or official having jurisdiction. For those islands that are elements of street and highway design and are included in the design of the street or highway, no specific authority is required.

All regulatory devices, if they are to be enforced, need to be backed by applicable laws, ordinances, or regulations. Effective traffic control depends not only on appropriate application of devices, but on reasonable enforcement of regulations as well. Standards in this Manual are based on that concept.

1A-4 Engineering Study Required

The decision to use a particular device at a particular location should be made on the basis of an engineering study of the location. Thus, while this Manual provides standards for design and application of traffic control devices, the Manual is not a substitute for engineering judgment. It is the intent that the provisions of this Manual be standards for traffic control devices installation, but not a legal requirement for installation.

Qualified engineers are needed to exercise the engineering judgement inherent in the selection of traffic control devices, just as they are needed to locate and design the roads and streets which the devices complement. Jurisdictions with responsibility for traffic control, that do not have qualified engineers on their staffs, should seek assistance from the State highway department, their county, a nearby large city, or a traffic consultant.

1A-5 Meanings of "Shall," "Should" and "May"

In the Manual sections dealing with the design and application of traffic control devices, the words "shall," "should" and "may" are used to describe specific conditions concerning these devices. To clarify the meanings intended in this Manual by the use of these words, the following definitions apply:

1. SHALL—A *mandatory* condition. Where certain requirements in the design or application of the device are described with the "shall" stipulation, it is mandatory when an installation is made that these requirements be met.

2. SHOULD—An *advisory* condition. Where the word "should" is used, it is considered to be advisable usage, recommended but not mandatory.

3. MAY—A *permi[illegible]e* condition. No requirement for design or application is intended

1A-6 Developing New Standards and Interpretation and Revision of Existing Standards

Advances in technology will produce changes in the highway, the vehicle, and in driver proficiency and portions of the system of control devices in this Manual will gradually become obsolete. In addition, unique situations often arise for device applications which may require interpretation or clarification of this Manual. It is important to have a procedure for recognizing these developments and for introducing new ideas and modifications into the system.

The following procedures will generally apply to the handling of interpretations, experimentation and changes to the MUTCD:

1. Requests for any interpretation, permission to experiment or change may be sent to one of the appropriate organizations of the National Advisory Committee or directly to the NAC Executive Director, Office of Traffic Operations, HTO-20, Federal Highway Administration, Washington, D.C., 20590. Requests forwarded to particular organizations will provide them the opportunity to review the submission and comment before forwarding them to the NAC Executive Director.

2. Requests for interpretation or change in the Manual should contain the following information:
   - (a) A statement indicating what change, modification, or question is to be resolved.
   - (b) Any illustration which would be helpful to understand the request.
   - (c) Any supporting research data which is pertinent to the item to be reviewed.

3. Requests for permission to experiment should contain the following information:
   - (a) A statement indicating the nature of the problem.
   - (b) A description of the proposed change, how it was developed, the manner in which it deviates from the standard, and how it is expected to be an improvement over existing standards.
   - (c) Any illustration which would be helpful to understand the experimental device or use of this device.
   - (d) Any supporting data as to how the experimental device was developed, if it has been tried, in what ways it was found to be adequate or inadequate, and how this choice of device or application was arrived at.

Additional details are available from the Federal Highway Administration.

4. Request will be classified as follows:

   (a) *Interpretation*—this includes application and operation of standard traffic control devices, official meanings of standard traffic control devices, or variations from standard device designs.

   (b) *Change*—this includes consideration of new devices to replace a present standard device, or revisions to recommended application or meaning criteria.

   (c) *Experimentation*—this includes consideration of testing or evaluating a new traffic control device, its application or manner of use.

5. The Federal Highway Administration will be responsible for notifying the party originating the request and providing the parent organization of the National Advisory Committee with a copy of each official ruling.

6. The Federal Highway Administration will maintain files on all officially designated requests and actions taken on the development of improved standards.

7. Periodically, text revisions and approved interpretations and experimentations will be published and distributed by the Government Printing Office to those Manual owners shown on the GPO subscription list. For additional copies or information about such revisions, write to the Federal Highway Administration (HTO-20), Washington, D.C. 20590.

1A-7 Relation to Other Documents

Two publications by the National Committee on Uniform Traffic Laws and Ordinances are specifically designed to provide the content and language of legislation needed to give regulatory devices the same meaning in all jurisdictions. These are the Uniform Vehicle Code (chapter 11, Rules of the Road) for States, and the Model Traffic Ordinance for municipalities. Both the Code and the Ordinance require the placing of signs or other traffic control devices to make some of their provisions effective, and both define the legal meaning of certain devices. The Code directs the State authorities to adopt a manual for a uniform system of traffic control devices, and requires all devices to conform thereto. The Ordinance also requires municipal devices to conform with the State manual. The adoption of appropriate legislation is an essential step toward uniformity.

To the extent they are incorporated by specific reference, the following documents are made a part of this Manual:

Standard Alphabets for Highway Signs and Pavement Markings, Federal Highway Administration, 1977 Edition.

Standard Color Tolerance Charts, Federal Highway Administration, 1970.

Standard Highway Signs, Federal Highway Administration, 1979 Edition.

Vehicle Traffic Control Signal Head Equipment Standards, Institute of Transportation Engineers, 1985.

Pedestrian Traffic Control Signal Indications, Institute of Transportation Engineers, 1985.

Standard for Flashing and Steady Burn Barricade Warning Lights, Institute of Transportation Engineers, 1981.

Standard for Traffic Signal Lamps, Institute of Transportation Engineers, 1980.

Other documents that are useful sources of information with respect to utilization of these standards include:

Transportation and Traffic Engineering Handbook, Institute of Transportation Engineers, 1982.

Highway Capacity Manual, Transportation Research Board.

A Policy on Geometric Design of Highways and Streets, American Association of State Highway and Transportation Officials, 1985.

Guidelines for the Selection of Supplemental Guide Signs for Traffic Generators Adjacent to Freeways, American Association of State Highway and Transportation Officials, 1984. II-76(c) Rev. 4

List of Control Cities for Use in Guide Signs on Interstate Highways, American Association of State Highway and Transportation Officials, 1984. II-77(c) Rev. 4

Manual on Traffic Engineering Studies, Institute of Transportation Engineers, 1976.

Volume 12, Highway Safety Program Manual, Highway Design, Construction and Maintenance, Federal Highway Administration.

Volume 13, Highway Safety Program Manual, Traffic Engineering Services, Federal Highway Administration.

Traffic Control Devices Handbook—Federal Highway Administration, 1983.

1A-8 Color Code

The following color code establishes general meanings for eight colors in a total of twelve colors that have been identified as being appropriate for use in conveying traffic control information. Central values and tolerance limits for each color are available.*

The four colors for which no meaning has been assigned are being reserved for future applications. The meanings described in this Section are of a general nature. More specific assignments of colors are given in the individual Parts of this Manual relating to each class of devices.

Color Code:

YELLOW—General Warning.
RED—Stop or prohibition.
BLUE—Motorist Services guidance.
GREEN—Indicated movements permitted, direction guidance.
BROWN—Recreational and cultural interest guidance.
ORANGE—Construction and maintenance warning.
BLACK—Regulation.
WHITE—Regulation.
PURPLE—Unassigned.
STRONG YELLOW—GREEN—Unassigned.
LIGHT BLUE—Unassigned.
CORAL—Unassigned.

1A-9 Definitions of Words and Phrases

Unless otherwise defined herein, definitions contained in the most recent editions of the Uniform Vehicle Code, AASHTO Highway Definitions, and other documents specified in section lA-7 are also incorporated and adopted by reference.

Unless otherwise defined herein, the term "roadway" shall be defined as: "That portion of a highway improved, designed, or ordinarily used for vehicular travel, exclusive of the berm or shoulder. In the event a highway includes two or more separate roadways, the term 'roadway' as used herein, refers to any such roadway separately, but not to all such roads collectively." I-2 (I) Rev. 3

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* Available from the Federal Highway Administration, (HTO-20), Washington, D.C. 20590.

PART II Signs
A Intro. & Gen. Specs.

Part II. SIGNS

A. INTRODUCTION AND GENERAL STANDARDS

2A-1 Function of Signs

Signs should be used only where warranted by facts and field studies. Signs are essential where special regulations apply at specific places or at specific times only, or where hazards are not self-evident. They also give information as to highway routes, directions, destinations and points of interest. Signs ordinarily are not needed to confirm rules of the road.

2A-2 Scope of Sign Standards

This Manual prescribes standards for the signing within the right-of-way of all classes of public highways. Detailed standards for Regulatory signs are given in Part II-B and for Warning signs in Part II-C.

The requirements and standards for Guide signs will depend on the particular highway class on which they are to be used. For this purpose the following meanings apply:

1. Conventional Road—A street or highway other than a freeway or expressway.
2. Expressway—A divided highway with partial control of access.
3. Freeway—A divided highway with full control of access.

Guide sign requirements for conventional roads are given in Part II-D, for expressways in Part II-E and for freeways in Part II-F. Expressways are characterized by three distinctive features—divided roadways, controlled access, and some grade separated intersections. Where any of these features are lacking, prescribed expressway signs may not be fully applicable and standard signs for conventional roads should be used, with such enlargement or other modification as is required to adapt them to existing conditions.

Standard guide signing for the National System of Interstate and Defense Highways shall be in accordance with Part II-F, Freeways. As many provisions for expressway signing have application on freeways, references are made to Part II-E to minimize duplication.

Signing for Civil Defense emergencies is contained in Part II-G.

Roadway geometric design and signing should be coordinated so that signing can be effectively placed to give the motorist necessary directional and warning information.

This Manual contains four special Parts which will be published separately:

1. Part VI — Traffic Controls for Street and Highway Construction and Maintenance Operations.
2. Part VII — Traffic Controls for School Areas.
3. Part VIII — Traffic Control Systems for Railroad-Highway Grade Crossings.
4. Part IX — Traffic Controls for Bicycle Facilities.

Publication of separate Parts VI through IX has been anticipated, in each case, through recognition of the need for that subject matter to be available in comprehensive and concise form. Each of these sections is meant to "stand on its own" as a thorough treatment of a specialized transportation topic.

2A-3 Legal Authority

Traffic signs shall be placed only by the authority of a public body or official having jurisdiction, for the purpose of regulating, warning, or guiding traffic. No traffic sign or its support shall bear any message that is not essential to traffic control. Specific reference is made to Section 11-205 of the Uniform Vehicle Code.

Any unauthorized sign placed on the highway right-of-way by a private organization or individual constitutes a public nuisance. All unofficial and nonessential signs should be removed.

With proper authority being given, construction contractors and public utility companies are permitted to erect construction and maintenance signs at work sites to protect the public, equipment, and workmen, provided that such signs conform to the standards of this Manual.

Effective traffic control depends not only on appropriate application of devices, but on reasonable enforcement of regulations as well. Standards in this Manual are based on that concept.

2A-4 Standardization of Application

Each standard sign shall be displayed only for the specific purpose prescribed for it in this Manual. Before any new highway, detour, or temporary route is opened to traffic all necessary signs shall be in place.

Signs required by road conditions or restrictions shall be removed immediately when those conditions cease to exist or the restrictions are withdrawn.

Uniformity of application is as important as standardization with respect to design and placement. Identical conditions should always be marked with the same type of sign, irrespective of where those particular conditions occur.

Determination of the particular sign or signs to be applied to a specific condition shall ordinarily be made in accordance with the criteria set forth in the following pages. However, engineering judgment is essential to the proper use of signs, the same as with other traffic control devices. Traffic engineering studies may indicate that signs would be unnecessary at certain locations. The judgment resulting from traffic engineering studies of physical and traffic factors should be depended upon to determine locations where signs are deemed necessary.

With the increase in traffic volumes and the desire to provide motorists information in addition to regulatory, warning, and directional guidance, there is a need to establish an order of priority for sign installation. This is especially critical where space is limited for sign installation and there is a demand for several different types of signs. Overloading motorists with too much information can cause improper driving and impair safety. Some information is more important than other information. Generally, in case of conflict, regulatory and warning signing whose location is critical should be displayed rather than guide signing. Information of a less important nature and extraneous information should be moved to less critical locations or deleted. (Additional guidance on prioritizing of signs is contained in the Traffic Control Devices Handbook.) II-27 (c)

It is recognized that urban traffic conditions differ from rural, and in many instances signs must be applied and located differently. Where pertinent and practical, therefore, this Manual sets forth separate recommendations for rural and urban conditions.

2A-5 Variable Message Signs

Variable message signs are designed to have one or more messages that may be displayed or deleted as required. Such a sign may be changed manually, by remote control, or by automatic controls that can "sense" the conditions that require special sign messages.

Variable message signs, with more sophisticated technologies, are gaining more widespread use to inform motorists of variable situations, particularly along more congested traffic corridors.

It is recognized that due to technological limitations many variable message signs cannot conform to the exact sign shape, color and dimensions specified in these standards. Because technology is developing so rapidly in this area of signing, this Manual has not specified detailed standards for variable message signs. Nevertheless, it is essential that variable message signs ascribe to the principles established in the Manual, and to the extent practicable, with the design and applications prescribed herein.

Highway and transportation organizations are encouraged to develop and experiment with variable message signs (sec. 1A-6) and to carefully evaluate installations where used so that specific Manual standards may be incorporated in the future.

2A-6 Excessive Use of Signs

Care should be taken not to install too many signs. A conservative use of regulatory and warning signs is recommended as these signs, if used to excess, tend to lose their effectiveness. On the other hand, a frequent display of route markers and directional signs to keep the driver informed of his location and his course will not lessen their value.

2A-7 Classification of Signs

Functionally, signs are classified as follows:

Regulatory signs give notice of traffic laws or regulations.

Warning signs call attention to conditions on, or adjacent to, a highway or street that are potentially hazardous to traffic operations.

Guide signs show route designations, destinations, directions, distances, services, points of interest, and other geographical, recreational, or cultural information.

2A-8 Standardization of Signs

In situations where messages are required other than those herein provided for, the signs shall be of the same shape and color as standard signs of the same functional type.

The term "legend" as used in this Manual includes all word messages and symbol designs that are intended to convey specific meanings. For purposes of design, borders are included as part of the sign legend.

The basic requirements of a highway sign are that it be legible to those for whom it is intended and that it be understood in time to permit a proper response. This means high visibility, lettering or symbols of adequate size, and a short legend for quick comprehension by a driver approaching a sign at high speed. Standardized colors and shapes are specified so that the several classes of traffic signs can be promptly recognized. Simplicity and uniformity in design, position, and application are important.

2A-9 Design

Uniformity in design includes shape, color, dimensions, legends, and illumination or reflectorization. This Manual shows many typical standard signs approved for use on streets and highways. Detailed drawings of these and other approved signs are available to State and local highway and traffic authorities, sign manufacturers, and similary interested agencies.* All symbols shall be unmistakably similar to those shown, and where a word message is applicable, the wording shall be as herein provided. Most standard symbols are oriented facing left; however, this does not preclude the use of mirror images of these symbols where the reverse orientation might better convey to vehicle operators a direction of movement. Standardization of these designs does not preclude further improvement by minor changes in the proportion of symbols, width of borders, or layout of word messages, but all shapes and colors shall be as indicated.

In the specifications for individual signs, the legend, color, and size are shown in the accompanying illustrations, and are not always detailed in the text.

2A-10 Shapes

Standard sign shapes are:

The octagon shall be reserved exclusively for the STOP sign.

The equilateral triangle, with one point downward, shall be reserved exclusively for the YIELD sign.

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* Available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590.

The round shape shall be used for the advance warning of a railroad crossing and for the civil defense evacuation route marker.

The pennant shape, an isosceles triangle, with its longest axis horizontal, shall be used to warn of no passing zones.

The diamond shape shall be used only to warn of existing or possible hazards either on the roadway or adjacent thereto.

The rectangle, ordinarily with the longer dimension vertical, shall be used for regulatory signs, with the exception of STOP signs and YIELD signs.

The rectangle, ordinarily with the longer dimension horizontal, shall be used for guide signs, with the exception of certain route markers and recreational area guide signs.

The trapezoid shape, as shown in section 2D-44, may be used for recreational area guide signs.

The pentagon, point up, shall be used for School Advance and School Crossing signs (Part VII).

Other shapes are reserved for special purposes; for example, the shield or other characteristic design for route markers and crossbuck for railroad crossings.

2A-11 Sign Colors

The colors to be used on standard signs shall be as follows:

Red is used only as a background color for STOP signs, multiway supplemental plates, DO-NOT-ENTER messages, WRONG WAY signs and on Interstate route markers; as a legend color for YIELD signs, parking prohibition signs, the circular outline and diagonal bar prohibitory symbol.

Black is used as a background on ONE WAY signs, certain weigh station signs and night speed limit signs as specified herein. Black is used as a message on white, yellow and orange signs.

White is used as the background for route markers, guide signs, the Fallout Shelter Directional sign, and regulatory signs, except STOP signs, and for the legend on brown, green, blue, black and red signs.

Orange is used as a background color for construction and maintenance signs and shall not be used for any other purpose.

Yellow is used as a background color for warning signs, except where orange is specified herein, and for school signs (Part VII).

Brown is used as a background color for guide and information signs related to points of recreational or cultural interest.

Green is used as a background color for guide signs (other than those using brown or white), mileposts, and as a legend color with a white background for permissive parking regulations.

Blue is used as a background color for information signs related to motorist services (including police services and rest areas) and the Evacuation Route Marker.

Four other colors--purple, light blue, coral, and strong yellow-green—have been identified as suitable for highway use and are being reserved for future needs.

Whenever white is specified herein as a sign color, it is understood to include silver-colored reflecting coatings or elements that reflect white light.

2A-12 Dimensions

The sign dimensions prescribed in this Manual shall be standard for application on public highways. Increases above these standard sizes are desirable where greater legibility or emphasis is needed. For expressways and freeways, special designs or large signs are prescribed. In the enlargement of signs, standard shapes and colors shall be used and standard proportions shall be retained insofar as practicable. Wherever practical the overall dimensions of the sign plates should be increased in 6-inch increments. Sign sizes for use on the different classes of highways are shown in Standard Highway Signs*.

2A-13 Symbols

Symbol designs shall in all cases be essentially like those shown in this Manual and the Standard Highway Signs Booklet.

A broader use of symbols in preference to word messages is a desirable and important step toward the greater safety and facilitation of traffic.

Sometimes a change from word messages to symbols requires significant time for public education and transition. Consequently, this Manual includes educational plaques to accompany some new symbol signs.

All symbol signs which are readily recognizable by the public may be erected without educational plaques. New warning or regulatory symbol signs not readily recognizable by the public, shall be accompanied by an educational plaque which is to remain in place for at least 3 years after initial installation. No special effort need be made to remove educational plaques as long as they are in serviceable condition.

2A-14 Word Messages

Where applicable, standard wordings as shown in this Manual shall be used for sign legends. Word messages should be as brief as possible and the lettering should be large enough to provide the necessary legibility distance.

Abbreviations should be kept to a minimum, and should include only those that are commonly recognized and understood, such as Ave., Blvd., N. (for north), R. R., or Jct. Since long names can often be partially recognized by their length, it is sometimes permissible to put them in slightly smaller lettering than would otherwise be required.

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* Available from GPO, see page ii.

2A-15 Lettering

Sign lettering shall be in upper-case letters of the type approved by the Federal Highway Administration, except that destination names may be in lower-case lettering, with initial upper-case. Standard upper-case and lower-case alphabets have been prepared.*

Use of the Series B alphabet is restricted to street-name signs, parking signs, and other similar signs where limited breadth and stroke widths are required for design purposes.

As a guide to choice of alphabets, tests have shown that, for any given legend, better legibility can be obtained by using a relatively wide spacing between letters than by using wider and taller letters with a cramped space.

2A-16 Illumination and Reflectorization

Regulatory and warning signs, unless excepted in the standards covering a particular sign or group of signs, shall be reflectorized or illuminated to show the same shape and color both by day and night. All overhead sign installations should be illuminated where an engineering study shows that reflectorization will not perform effectively. Reflectorization, non-reflectorization, or illumination of guide signs shall be as provided in subsequent sections.

2A-17 Means of Illumination

Illumination may be by means of:

1. A light behind the sign face, illuminating the main message or symbol, or the sign background, or both, through a translucent material; or

2. An attached or independently mounted light source designed to direct essential uniform illumination over the entire face of the sign; or

3. Some other effective device, such as luminous tubing or fiber optics shaped to the lettering or symbol, patterns of incandescent light bulbs, or luminescent panels that will make the sign clearly visible at night.

The requirements for sign illumination are not considered to be satisfied by street or highway lighting, or by strobe lighting.

2A-18 Means of Reflectorization

Reflectorization may be by means of:

1. Reflector "buttons" or similar units set into the symbol, message and border; or

2. A material that has a smooth, sealed outer surface, either on the sign background; or where a white legend is used on a colored background, reflectorization may be used for the symbol or message and border. VI-11 (c)

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* Available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590.

2A-19 Sign Borders

With few exceptions, all signs illustrated herein shall have a border of the same color as the legend, at or just inside the edge. A dark border should be set in from the edge, while a white border should extend to the edge of the panel. A suitable border for 30-inch signs with a light background is from ½ to ¾ of an inch in width, ½ inch from the edge. For similar signs with a white border, a width of an inch is appropriate. For other sizes the border widths should be of similar proportions, but not to exceed the stroke-width of the major lettering of the sign. On signs exceeding 6 feet by 10 feet in size, the border should be approximately 2 inches wide, or on unusually large signs, 3 inches.

The corners of the sign border shall be rounded. Where practicable, the corners of the sign panels should also be rounded to fit the border.

2A-20 Supplemental Beacons

A hazard identification beacon (sec. 4E-1, 4E-2, 4E-5 and 7B-12) may be used only to supplement an appropriate warning or regulatory sign.

2A-21 Standardization of Location

Standardization of position cannot always be attained in practice; however, the general rule is to locate signs on the right-hand side of the roadway, where the driver is looking for them. On wide expressways, or where some degree of lane-use control is desirable, or where space is not available at the roadside, overhead signs are often necessary. Signs in any other locations ordinarily should be considered only as supplementary to signs in the normal locations. Under some circumstances signs may be placed on channelizing islands or (as on sharp curves to the right) on the left-hand shoulder of the road, directly in front of approaching vehicles. A supplementary sign located on the left of the roadway is often helpful on a multi-lane road where traffic in the right-hand lane may obstruct the view to the right.

Normally, signs should be individually erected on separate posts or mountings except where one sign supplements another or where route or directional signs must be grouped. In general, signs should be located to optimize nighttime visibility and minimize the effects of mud spatter and in conformance with safety factors related to fixed obstacles near the roadway. Signs should be located so that they do not obscure each other or are hidden from view by other roadside objects. Signs requiring different decisions by the vehicle operator must be spaced sufficiently far apart for the required decisions to be made safely. The spacing shall be determined in units of time as determined by the expected vehicle approach speed.

Standard positions for a number of typical signs are illustrated in figures 2-1 to 2-4.

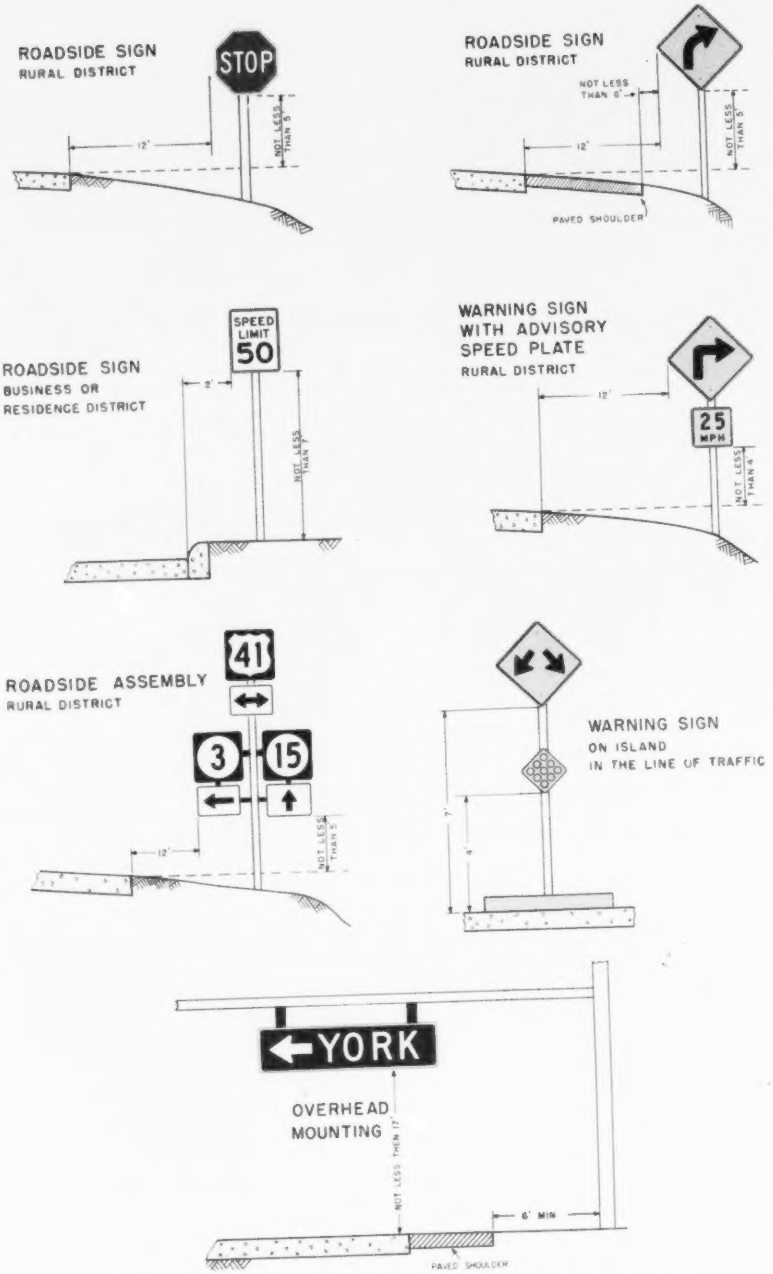
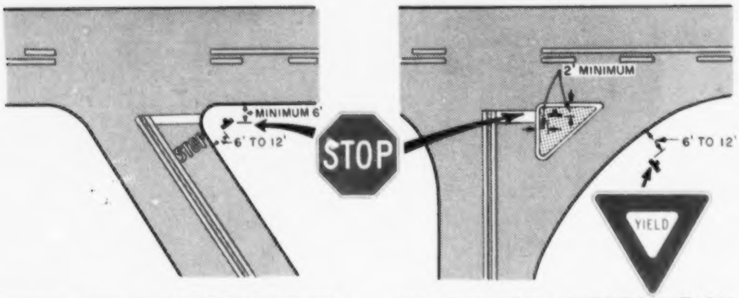
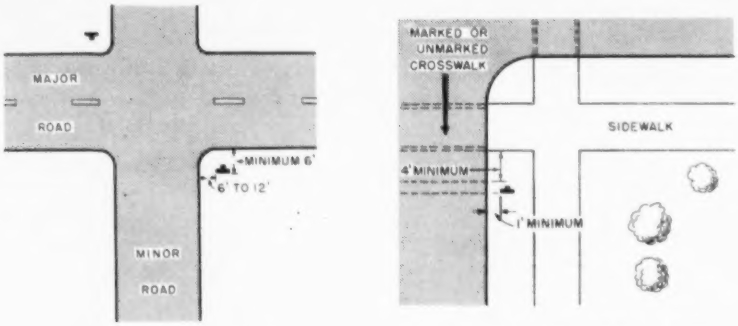

ROADSIDE SIGN
RURAL DISTRICT
STOP
12'
NOT LESS THAN 5'
ROADSIDE SIGN
RURAL DISTRICT
NOT LESS THAN 6'
12'
NOT LESS THAN 5'
PAVED SHOULDER
ROADSIDE SIGN
BUSINESS OR
RESIDENCE DISTRICT
SPEED LIMIT 50
2'
NOT LESS THAN 7'
WARNING SIGN
WITH ADVISORY
SPEED PLATE
RURAL DISTRICT
12'
25 MPH
NOT LESS THAN 4'
ROADSIDE ASSEMBLY
RURAL DISTRICT
41
3
15
12'
NOT LESS THAN 5'
WARNING SIGN
ON ISLAND
IN THE LINE OF TRAFFIC
7'
4'
YORK
OVERHEAD
MOUNTING
NOT LESS THEN 17'
6' MIN
PAVED SHOULDER

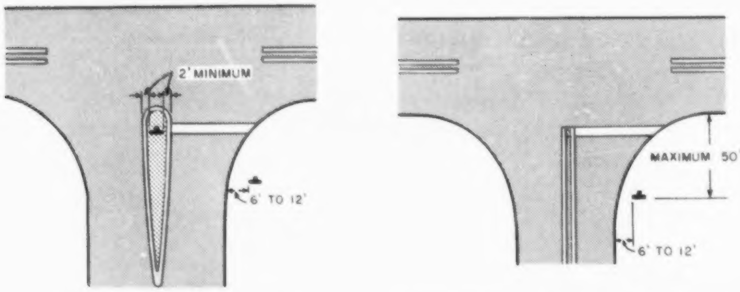
Figure 2-1. Height and lateral location of signs—typical installations.


MINIMUM 6'
6' TO 12'
STOP
STOP
2' MINIMUM
6' TO 12'
YIELD

ACUTE ANGLE INTERSECTION CHANNELIZED INTERSECTION


MAJOR
ROAD
MINIMUM 6'
6' TO 12'
MINOR
ROAD
MARKED OR
UNMARKED
CROSSWALK
SIDEWALK
4' MINIMUM
1' MINIMUM

MINOR CROSSROAD URBAN INTERSECTION


2' MINIMUM
6' TO 12'
MAXIMUM 50'
6' TO 12'

DIVISIONAL ISLAND WIDE THROAT INTERSECTION

Figure 2-2. Typical locations for stop signs and yield signs.

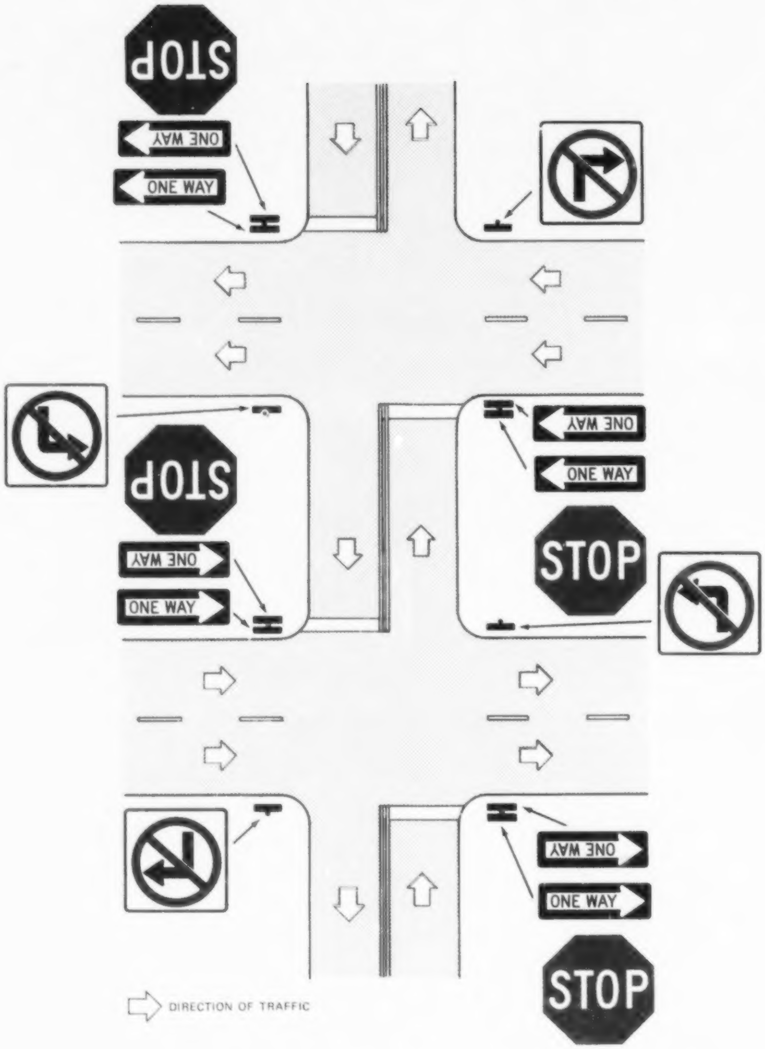
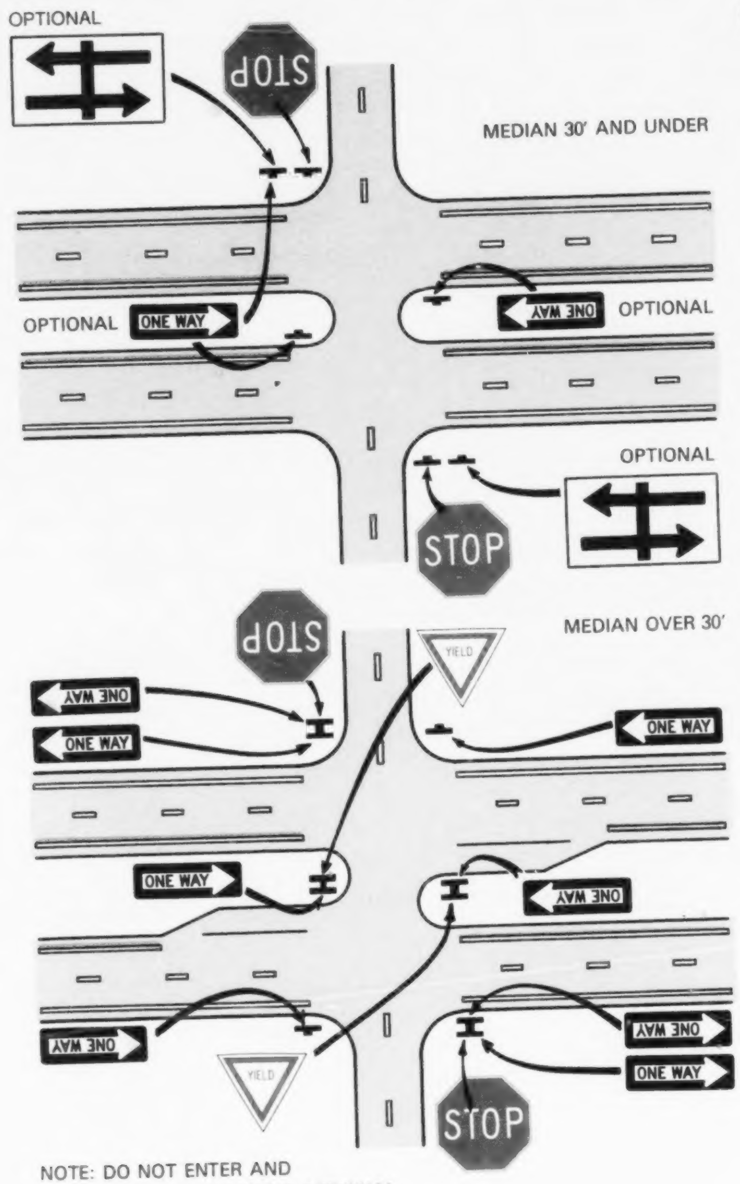

STOP
ONE WAY
ONE WAY
STOP
ONE WAY
ONE WAY
ONE WAY
ONE WAY
STOP
ONE WAY
ONE WAY
STOP
DIRECTION OF TRAFFIC

Figure 2-3. Location of one-way and turn prohibition signs.



MEDIAN 30' AND UNDER

MEDIAN OVER 30'

OPTIONAL
STOP
OPTIONAL
ONE WAY
ONE WAY
OPTIONAL
OPTIONAL
STOP
STOP
YIELD
ONE WAY
ONE WAY
ONE WAY
ONE WAY
ONE WAY
ONE WAY
ONE WAY
ONE WAY
YIELD
STOP

NOTE: DO NOT ENTER AND
WRONG WAY SIGNS OPTIONAL

Figure 2-3a. Alternate one way signing for divided highways

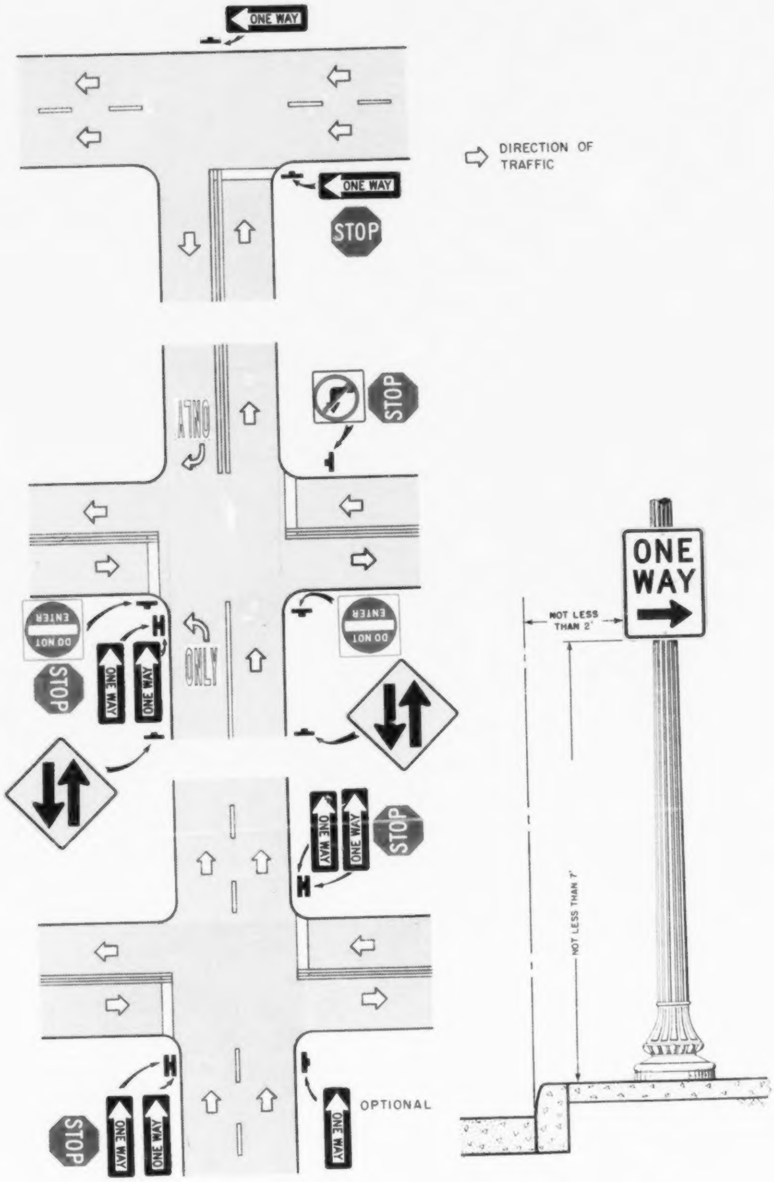

ONE WAY
DIRECTION OF TRAFFIC
ONE WAY
STOP
ONLY
STOP
DO NOT ENTER
ONE WAY
ONE WAY
STOP
ONLY
DO NOT ENTER
ONE WAY
ONE WAY
STOP
ONE WAY
ONE WAY
STOP
ONE WAY
OPTIONAL
ONE WAY
NOT LESS THAN 2'
NOT LESS THAN 7'

Figure 2-4. Typical location of one-way signs.

2A-22 Overhead Sign Installations

The operational requirements of our present highway system are such that overhead signs will have value at many locations. The factors justifying the erection of overhead sign displays are not definable in specific numerical terms, but the following conditions deserve consideration:

1. Traffic volume at or near capacity
2. Complex interchange design
3. Three or more lanes in each direction
4. Restricted sight distance
5. Closely spaced interchanges
6. Multi-lane exits
7. Large percentage of trucks
8. Street lighting background
9. High speed traffic
10. Consistency of sign message location through a series of interchanges
11. Insufficient space for ground mounted signs
12. Junction of an Interstate route with another freeway
13. Left exit ramps

The existence of any one or more of the conditions listed does not automatically justify the use of overhead signs. Some of the elements listed above can be made less critical by close coordination between design and operation.

2A-23 Height

Signs erected at the side of the road in rural districts shall be mounted at a height of at least 5 feet, measured from the bottom of the sign to the near edge of the pavement. In business, commercial and residential districts where parking and/or pedestrian movement is likely to occur or where there are other obstructions to view, the clearance to the bottom of the sign shall be at least 7 feet. The height to the bottom of a secondary sign mounted below another sign may be 1 foot less than the appropriate height specified above.

The height requirements for ground installations on expressways vary somewhat from those on conventional streets and highways. Directional signs on expressways shall be erected with a minimum height of 7 feet (from the level of the near edge of the pavement to the bottom of the sign). If, however, a secondary sign is mounted below another sign, the major sign shall be at least 8 feet and the secondary sign at least 5 feet above the level of the pavement edge. All route markers and warning and regulatory signs on expressways shall be at least 6 feet above the level of the pavement edge. However, where signs are placed 30 feet or more from the edge of the nearest traffic lane for increased roadside safety, the height to the bottom of such signs may be 5 feet above the level of the pavement edge.

A route marking assembly consisting of a route marker with an auxiliary plate (sec. 2D-10) is treated as a single sign for the purposes of this section.

Overhead signs shall provide a vertical clearance of not less than 17 feet over the entire width of the pavement and shoulders except where a lesser vertical clearance is used for the design of other structures. The vertical clearance to overhead sign structures or supports need not be greater than 1 foot in excess of the minimum design clearance of other structures. In special cases it may be necessary to reduce the clearance still further because of substandard dimensions in tunnels and other major structures such as double-deck bridges.

2A-24 Lateral Clearance

Signs should have the maximum practical lateral clearance from the edge of the traveled way for the safety of motorists who may leave the roadway and strike the sign supports. Advantage should be taken of existing guardrail, overcrossing structures and other conditions to minimize the exposure of sign supports to traffic. Otherwise, breakaway or yielding supports should be used.

Normally, signs should not be closer than 6 feet from the edge of the shoulder, or if none, 12 feet from the edge of the traveled way. In urban areas a lesser clearance may be used where necessary. Although 2 feet is recommended as a working urban minimum, a clearance of 1 foot from the curb face is permissible where sidewalk width is limited or where existing poles are close to the curb.

The minimum clearance outside the usable roadway shoulder for expressway signs mounted at the roadside or for overhead sign supports, either to the right or left side of the roadway, shall be 6 feet. This minimum clearance of 6 feet shall also apply outside of an unmountable curb. Where practicable, a sign should not be less than 10 feet from the edge of the nearest traffic lane. Large guide signs especially should be farther removed, preferably 30 feet or more from the nearest traffic lane. Lesser clearances, but not generally less than 6 feet, may be used on connecting roadways or ramps at interchanges.

Where an expressway median is 12 feet or less in width, consideration should be given to spanning both roadways without a center support. Butterfly-type signs and other overhead sign supports should not be erected in gores or other exposed locations. Where overhead sign supports cannot be placed a safe distance away from the line of traffic, or in an otherwise protected site, they should either be so designed as to minimize the impact forces, or otherwise protect motorists adequately by a physical barrier or guardrail of suitable design.

2A-25 Position of Signs

A warning sign is placed in advance of the condition to which it calls attention (fig. 2-5, page 2A-17). A regulatory sign normally is placed where its mandate or prohibition applies or begins. Guide signs are placed, where needed, to keep drivers well informed as to the route to their destination. Figures 2-7a, 7b, 7c (pages 2D-16 to 2D-18) show the placement of intersection guide signs on other than expressways. Detailed specifications for sign locations are given in the sections of the Manual dealing with an individual sign or classes of signs.

2A-26 Erection

Normally, signs should be mounted approximately at right angles to the direction of, and facing, the traffic that they are intended to serve.

Where mirror reflection from the sign face is encountered in such degree as to reduce legibility, the sign should be turned slightly away from the road. When signs are offset 30 feet or more from the pavement edge, signs should generally be turned toward the road. At curved alignments, the angle of placement should be determined by the course of approaching traffic rather than by the roadway edge at the point where the sign is located. Sign faces normally are vertical, but on grades it may be desirable to tilt a sign forward or back from the vertical to improve the viewing angle.

2A-27 Posts and Mountings

Sign posts and their foundations and sign mountings shall be so constructed as to hold signs in a proper and permanent position, to resist swaying in the wind or displacement by vandalism.

In areas where ground mounted sign supports cannot be sufficiently offset (sec. 2A-24) from the pavement edge, sign supports should be of a suitable breakaway or yielding design. Concrete bases for sign supports should be flush with the ground level.

In some cases, especially in urban districts, signs can be correctly placed on existing supports used for other purposes, such as traffic signals, street lights, and public utility poles where permitted, thereby saving expense and minimizing sidewalk obstruction.

2A-28 Bridges for Sign Supports

Overcrossing structures many times can serve for the support of overhead signs, and under some circumstances, may be the only practical solution that will provide adequate viewing distance. Use of such structures as sign supports will eliminate the need for the foundations and sign supports along the roadside. On urban freeways and expressways where overhead crossings are closely spaced, it is desirable to place signs on bridges to enhance safety and economy.

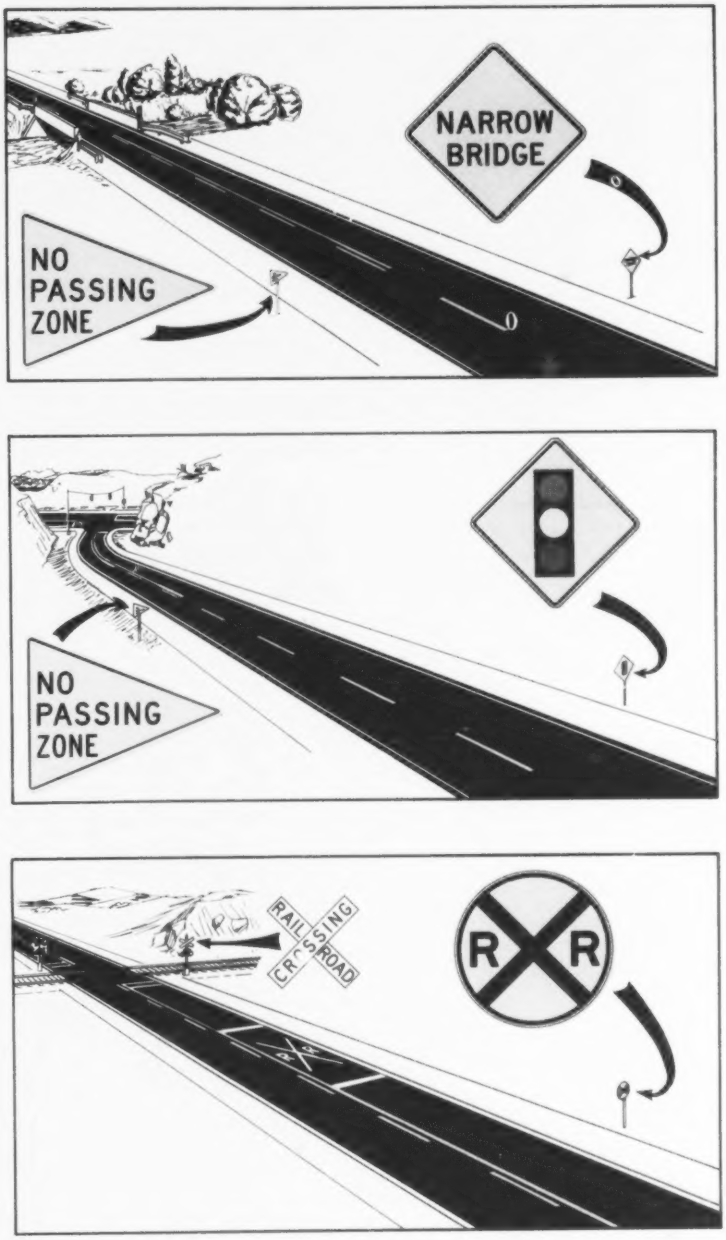

NARROW BRIDGE
NO PASSING ZONE
NO PASSING ZONE
RAILROAD CROSSING
R R

Figure 2-5. Typical applications of warning signs.

2A-29 Sign Materials

A variety of materials can be used effectively. However, it is recognized that technological progress may develop new and satisfactory or superior materials for highway signs, particularly in the fields of illumination and reflectorization. Nothing in this Manual should be interpreted to exclude any new material that meets the standard requirements for color and legibility, both by day and by night.

2A-30 Maintenance

All traffic signs should be kept in proper position, clean and legible at all times. Damaged signs should be replaced without undue delay.

To assure adequate maintenance, a suitable schedule for inspection, cleaning and replacement of signs should be established. Employees of street and highway organizations, police and other governmental employees whose duties require that they travel on the highways should be encouraged to report any damaged or obscured signs at the first opportunity.

Special attention and necessary action should be taken to see that weeds, trees, shrubbery and construction materials do not obscure the face of any sign.

A regular schedule of replacement of lighting elements for illuminated signs should be maintained.

2A-31 Wrong-Way Traffic Control

Efforts should be made to identify and make practical corrections at grade intersections on divided highways where wrong-way usage is being experienced or where a wide median, a rural unlighted environment or other contributing factors indicate the likelihood of wrong-way movements.

Where roadways are separated by median widths of 30 feet or more, the intersections with the crossroad shall be signed as two separate intersections and ONE WAY signs (Section 2B-29) should be visible to each crossroad approach on the near right-hand and far left-hand corners of each intersection with the directional roadways as shown in Figure 2-3. However, when an engineering study has demonstrated that placement of ONE WAY signs in the median area may create confusion, the near right-hand signs in the median may be omitted and ONE WAY signs placed in the far right quadrant of the intersection. Figure 2-3a shows that alternate signing scheme with one sign omitted from the median. The ONE WAY signs may be supplemented by a Turn Prohibition sign or by DO NOT ENTER or WRONG WAY signs. II-58 (c) Rev. 3

For median widths of less than 30 feet, the use of the ONE WAY signs at the intersection is optional. As an alternative, the use of the R6-3 Divided Highway Crossing sign may be considered.

If used, DO NOT ENTER and WRONG WAY signs should be placed on a divided highway at a location to be directly in view of a driver making a wrong-way entry from the crossroad. Additional signs may be placed where the median width is 30 feet or more.

Standard directional arrow pavement markings may be placed in each approach lane of each roadway in advance of a grade intersection and at other selected locations to indicate the direction of traffic flow.

At locations which are determined to have a special need, other standard warning or prohibitive methods and devices may be used as a deterrent to the wrong-way movement (Ref. sec. 2E-41).

B. REGULATORY SIGNS

2B-1 Application of Regulatory Signs

Regulatory signs inform highway users of traffic laws or regulations and indicate the applicability of legal requirements that would not otherwise be apparent. These signs shall be erected wherever needed to fulfill this purpose, but unnecessary mandates should be avoided. The laws of many States specify that certain regulations are enforceable only when made known by official signs.

Some regulatory signs are related to operational controls but do not impose any obligations or prohibitions. For example, signs giving advance notice of or marking the end of a restricted zone are included in the regulatory group.

Regulatory signs normally shall be erected at those locations where regulations apply. The sign message shall clearly indicate the requirements imposed by the regulation and shall be easily visible and legible to the vehicle operator.

2B-2 Classification of Regulatory Signs

Regulatory signs are classified in the following groups:

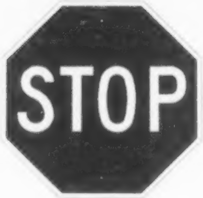
1. Right-of-way series:
   - (a) STOP sign (sec. 2B-4 to 6)
   - (b) YIELD sign (sec. 2B-7 to 9)
2. Speed series (sec. 2B-10 to 14)
3. Movement series:
   - (a) Turning (sec. 2B-15 to 19)
   - (b) Alignment (sec. 2B-20 to 25)
   - (c) Exclusion (sec. 2B-26 to 28)
   - (d) One Way (sec. 2B-29 to 30)
4. Parking series (sec. 2B-31 to 34)
5. Pedestrian series (sec. 2B-35 to 36)
6. Miscellaneous series (sec. 2B-37 to 44)

2B-3 Design of Regulatory Signs

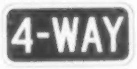
Regulatory signs are rectangular, with the longer dimension vertical, and have black legend on a white background, except for those signs whose standards specify otherwise.

All regulatory signs shall be reflectorized or illuminated to show the same shape and color both by day and by night, unless excepted in the standards covering a particular sign or group of signs.

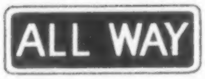
For use of educational plaques with symbol signs see section 2A-13.



R1–1
30" x 30"



R1–3
12" x 6"



R1–4
18" x 6"

2B-4 Stop Sign (R1-1)

STOP signs are intended for use where traffic is required to stop. The STOP sign shall be an octagon with white message and border on a red background. The standard size shall be 30 × 30 inches. Where greater emphasis or visibility is required, a larger size is recommended. On low-volume local streets and secondary roads with low approach speeds, a 24 × 24 inch size may be used.

At a multiway stop intersection (sec. 2B-6), a supplementary plate (R1-3) should be mounted just below each STOP sign. If the number of approach legs to the intersection is three or more, the numeral on the supplementary plate shall correspond to the actual number of legs, or the legend ALL-WAY (R1-4) may be used. The supplementary plate shall have white letters on a red background and shall have a standard size of 12 × 6 inches (R1-3) or 18 × 6 inches (R1-4).

A STOP sign beacon or beacons may be used in conjunction with a STOP sign as described in section 4E-4.

Secondary messages shall not be used on STOP sign faces.

2B-5 Warrants for Stop Sign

Because the STOP sign causes a substantial inconvenience to motorists, it should be used only where warranted. A STOP sign may be warranted at an intersection where one or more of the following conditions exist:

1. Intersection of a less important road with a main road where application of the normal right-of-way rule is unduly hazardous.
2. Street entering a through highway or street.
3. Unsignalized intersection in a signalized area.
4. Other intersections where a combination of high speed, restricted view, and serious accident record indicates a need for control by the STOP sign.

Prior to the application of these warrants, consideration should be given to less restrictive measures, such as the YIELD sign (2B-7) where a full

II-48 (c)
Rev. 3

stop is not necessary at all times. Periodic reviews of existing installations may be desirable to determine whether, because of changed conditions, the use of less restrictive control or no control could accommodate traffic demands safely and more effectively. II-48 (c) Rev. 3

STOP signs should never be used on the through roadways of expressways. Properly designed expressway interchanges provide for the continuous flow of traffic, making STOP signs unnessary even on the entering roadways. Where at-grade intersections are temporarily justified for local traffic in sparsely populated areas, STOP signs should be used on the entering roadways to protect the through traffic. STOP signs may also be required at the end of diverging roadways at the intersection with other highways not designed as expressways. In most of these cases, the speeds will not warrant any great increase in the sign sizes.

STOP signs shall not be erected at intersections where traffic control signals are operating. The conflicting commands of two types of control devices are confusing. If traffic is required to stop when the operation of the stop-and-go signals is not warranted, the signals should be put on flashing operation with the red flashing light facing the traffic that must stop.

Where two main highways intersect, the STOP sign or signs should normally be posted on the minor street to stop the lesser flow of traffic. Traffic engineering studies, however, may justify a decision to install a STOP sign or signs on the major street, as at a three-way intersection where safety considerations may justify stopping the greater flow of traffic to permit a left-turning movement.

STOP signs may be used at selected railroad-highway grade crossings only after their need has been determined by a detailed traffic engineering study. Use of the STOP sign at railroad-highway grade crossings is described in Section 8B-9. VIII-5 (c) Rev. 2

Portable or part-time STOP signs shall not be used except for emergency purposes. Also, STOP signs should not be used for speed control.

2B-6 Multiway Stop Signs

The "Multiway Stop" installation is useful as a safety measure at some locations. It should ordinarily be used only where the volume of traffic on the intersecting roads is approximately equal. A traffic control signal is more satisfactory for an intersection with a heavy volume of traffic.

Any of the following conditions may warrant a multiway STOP sign installation (sec. 2B-4):

1. Where traffic signals are warranted and urgently needed, the multiway stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the signal installation.

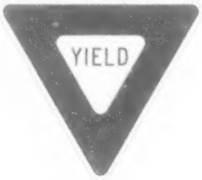
2. An accident problem, as indicated by five or more reported accidents of a type susceptible of correction by a multiway stop installation in a 12-month period. Such accidents include right- and left-turn collisions as well as right-angle collisions.

3. Minimum traffic volumes:
   (a) The total vehicular volume entering the intersection from all approaches must average at least 500 vehicles per hour for any 8 hours of an average day, and
   (b) The combined vehicular and pedestrian volume from the minor street or highway must average at least 200 units per hour for the same 8 hours, with an average delay to minor street vehicular traffic of at least 30 seconds per vehicle during the maximum hour, but
   (c) When the 85-percentile approach speed of the major street traffic exceeds 40 miles per hour, the minimum vehicular volume warrant is 70 percent of the above requirements.

2B-7 Yield Sign (R1-2)

The YIELD sign assigns right-of-way to traffic on certain approaches to an intersection. Vehicles controlled by a YIELD sign need stop only when necessary to avoid interference with other traffic that is given the right-of-way.

The YIELD sign shall be a downward pointing, equilateral triangle having a red border band and a white interior and the word YIELD in red inside the border band. The standard size shall be 36 × 36 × 36 inches.



R1–2
36" x 36" x 36"

2B-8 Warrants for Yield Signs

The YIELD sign may be warranted:

1. On a minor road at the entrance to an intersection where it is necessary to assign right-of-way to the major road, but where a stop is not necessary at all times, and where the safe approach speed on the minor road exceeds 10 miles per hour.

2. On the entrance ramp to an expressway where an acceleration lane is not provided.

3. Within an intersection with a divided highway, where a STOP sign is present at the entrance to the first roadway and further control is necessary at the entrance to the second roadway, and where the median width between the two roadways exceeds 30 feet.

4. Where there is a separate or channelized right-turn lane, without an adequate acceleration lane.

5. At any intersection where a special problem exists and where an engineering study indicates the problem to be susceptible to correction by use of the YIELD sign.

YIELD signs should not ordinarily be placed to control the major flow of traffic at an intersection. They should not be erected on the approaches of more than one of the intersecting streets or highways or used at any intersection where there are STOP signs on one or more approaches, except, under special circumstances, to provide minor movement control within complex intersections.

YIELD signs should not be used on the through roadways of expressways. They may be used on an entering roadway without an adequate acceleration lane, but in a well designed interchange, the sign would interfere with the free merging movement, and it should not be used under those circumstances.

2B-9 Location of Stop Sign and Yield Sign

A STOP sign should be erected at the point where the vehicle is to stop or as near thereto as possible, and may be supplemented with a Stop line and/or the word STOP on the pavement, as shown in figure 2-2 (page 2A-10). A YIELD sign should be erected in the same manner, at the point where the vehicle is to stop if necessary to yield the right-of-way. Where there is a marked crosswalk on the pavement, the sign should be erected approximately 4 feet in advance of the crosswalk line nearest to approaching traffic.

Where only one sign, STOP or YIELD, is used, it shall be on the right-hand side of the traffic lane to which it applies. At an intersection where a wide throat exists on the signed approach, observance of the sign may be improved by the erection of an additional sign on the left side of the approach road, and by the use of a Stop line. Where two lanes of traffic are subject to the STOP sign, a second sign should be placed where it is visible to traffic in the inner lane. At certain channelized intersections, the additional sign may be effectively placed on a channelizing island. In no instance shall one STOP or YIELD sign be mounted above another on the same post.

Where two roads intersect at an acute angle, the STOP or YIELD sign should be positioned at an angle, or shielded, so that the message is out of view of traffic to which it does not apply.

In the event the visibility of a STOP sign or a YIELD sign at any location is restricted, the sign shall be located as specified, and a Stop Ahead sign (sec. 2C-15) or a Yield Ahead sign (sec. 2C-16) shall be erected in advance of the STOP or YIELD sign.

Figures 2-2, 2-7a, 2-7b, and 2-7c (pages 2A-10 and 2D-16 to 2D-18) show typical STOP and YIELD sign installations.

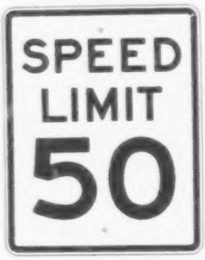
2B-10 Speed Limit Sign (R2-1)

The Speed Limit sign shall display the limit established by law, or by regulation, after an engineering and traffic investigation has been made in accordance with established traffic engineering practices. The speed limits shown shall be in multiples of 5 miles per hour.

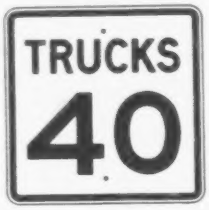
In order to determine the proper numerical value for a speed zone on the basis of an engineering and traffic investigation the following factors should be considered:

1. Road surface characteristics, shoulder condition, grade, alignment and sight distance.
2. The 85-percentile speed and pace speed.
3. Roadside development and culture, and roadside friction.
4. Safe speed for curves or hazardous locations within the zone.
5. Parking practices and pedestrian activity.
6. Reported accident experience for a recent 12-month period.

Two types of speed limit signs may be used: One to designate passenger car speeds including any nighttime information or minimum speed limit that might apply, and the other to show any special speed limits for buses and trucks. No more than three speed limits should be displayed on any one speed limit sign or assembly. Where a special speed limit applies to trucks or other vehicles, the legend TRUCKS 40, or such similar message as is appropriate, shall be shown below the standard



R2-1
24" x 30"



R2-2
24" x 24"

message or on a separate plate (R2-2). When used independently, the Truck Speed sign should carry a reference to SPEED or MPH.

Minimum speeds shall be displayed only in combination with the posted speed limit (sec. 2B-12).

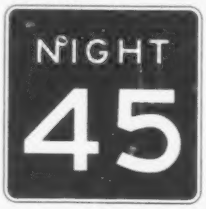
Advisory Speed signs are treated under section 2C-35.

The standard Speed Limit sign shall be 24 × 30 inches. On expressways the sign should be at least 36 × 48 inches, with 48 × 60 inches prescribed for use on freeways.

2B-11 Night Speed Sign (R2-3)

Where different speed limits are prescribed for day and night, both the limits shall be posted. This may be done in either of two ways:

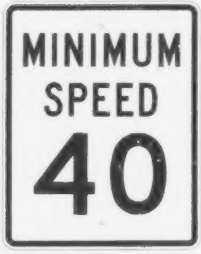
1. Immediately below the standard Speed Limit sign (R2-1) or combined with it, a Night Speed sign (R2-3) carrying the legend NIGHT 45 (or other suitable numerical limit) may be erected. In this case the numerals in the Night Speed sign and only the words SPEED LIMIT in the standard sign, should be reflectorized. As a special but logical exception to the general color scheme, the Night Speed sign should have its legend in white upon a black background.
2. A changeable message sign may be used, so that only the appropriate regulation is visible at a given time. The sign may have interchangeable panels, or reflectorization of the nighttime speed superimposed over the unreflectorized numerals of the daytime speed, to permit only the nighttime speed to become legible in the beam of motor-vehicle headlamps at night.



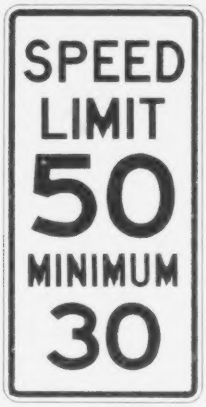
R2-3
24" x 24"

2B-12 Minimum Speed Sign (R2-4)

Where an engineering and traffic investigation shows that slow speeds on a highway consistently impede the normal and reasonable movement of traffic, signs may be used to post a minimum legal speed. Driving slower than the minimum limit is illegal except when necessary for safe operation or in compliance with the law. The minimum speed shall be displayed only in combination with the posted speed limit, and if desired, these two signs may be combined (R2-4a). The Minimum Speed sign shall have a standard, and minimum, size of 24 × 30 inches.



R2–4
24" x 30"



R2–4a
24" x 48"

2B–13 Location of Speed Limit Sign

Speed Limit signs, indicating speed limits for which posting is required by law, shall be located at the points of change from one speed limit to another. These signs shall not be erected until the speed limits are approved and officially authorized.

At the end of the section to which a speed limit applies, a Speed Limit sign showing the next speed limit shall be erected. Additional signs shall be installed beyond major intersections and at other locations where it is necessary to remind motorists of the limit that is applicable. In school areas, the END SCHOOL ZONE sign may be used as an alternate to the Speed Limit Sign.

II–45 (c)
Rev. 3

The Speed Zone Ahead sign (sec. 2B–14) may be used to give advance notice of a speed zone with a lower limit.

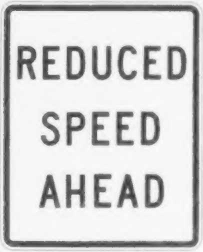
In rural districts on U.S. and other State numbered routes, Speed Limit signs indicating the statutory speed limits shall be erected at entrances to the State and at boundaries of metropolitan areas. A special oversize sign is often desirable at these locations.

2B–14 Sign for Reduced Speed Ahead (R2–5)

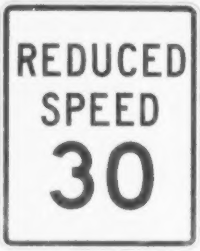
This sign should be used in rural areas to inform the motorist of a reduced speed zone when an advance notice is needed to comply with the speed limit posted ahead. The sign is not ordinarily needed in urban areas where speeds are relatively low.

This sign shall always be followed by a Speed Limit sign erected at the beginning of the zone where the altered speed limit applies.

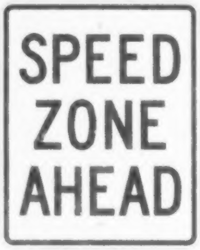
This sign shall have a standard size of 24 × 30 inches. It shall, however, be of the same size as the Speed Limit sign at the beginning of the speed zone, shall be erected in the same manner, and shall display one of the three illustrated legends.



R2–5a
24" x 30"



R2–5b
24" x 30"



R2–5c
24" x 30"

2B-15 Turn Prohibition Signs (R3-1 to 3)

Turn Prohibition signs should be used to indicate the turns that are prohibited or restricted at a particular intersection.

The standard, and minimum, size of the No Right Turn sign (R3-1), the No Left Turn sign (R3-2), and the NO TURNS sign (R3-3) shall be 24 × 24 inches.

Turn Prohibition signs should be placed where they will be most easily seen by drivers intending to turn. Where No Right Turn signs are needed, at least one should be placed either over the roadway or at a right-hand corner of the intersection. If signals are present, the sign may be installed adjacent to a signal face viewed by motorists in the right lane.

Where No Left Turn signs are needed, at least one should be placed over the roadway or at a left-hand corner of the intersection. If signals are present, the sign may be installed adjacent to a signal face viewed by motorists in the left lane. Where No Turns signs are needed, two signs should be used, one at a location specified for a No Right Turn sign and one at a location specified for a No Left Turn sign. If signals are present, a No Turns sign may be placed adjacent to a signal face viewed by all motorists on that approach.

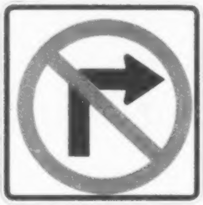
II-10 (c)
Rev. 3

If advance signs are used, care should be taken that no alley or public driveway exists between them and the intersection where the turning movement is prohibited. At an intersection where one or more approaches to the intersection are limited to one-way traffic, whether signalized or not, the ONE WAY sign (sec. 2B-29) shall be used, and may be supplemented by the Turn Prohibition sign (fig. 2-3, page 2A-11). A Turn Prohibition sign is not needed at a ramp entrance to an expressway where the design is such as to indicate clearly the one-way traffic movement on the ramp. The DO NOT ENTER sign (sec. 2B-26) will serve in lieu of the Turn Prohibition sign where it is necessary to emphasize the one-way traffic movement on the ramp.

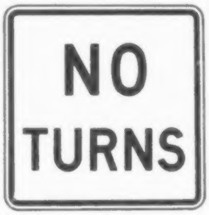
When the movement restriction applies during certain periods only, the use of Turn Prohibition signs calls for special treatment. The following alternatives are listed in order of preference:

1. Variable message signs or internally illuminated signs that are lighted and made legible only during the restricted hours, particularly desirable at signalized intersections.
2. Permanently mounted signs incorporating a supplementary legend showing the hours during which the prohibition is applicable.
3. Portable signs off the roadway at each corner of the intersection where required, put in place under police supervision only when applicable and removed at other hours.

The appropriate word message, NO RIGHT TURN or NO LEFT TURN, on a 24 x 30 inch panel may be used as an alternate.



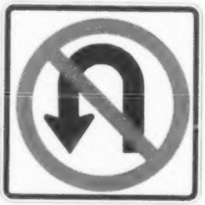
R3–1
24" x 24"



R3–3
24" x 24"

2B-16 U-Turn Prohibition Sign (R3-4)

The U-Turn Prohibition sign is intended for use at or between intersections to indicate locations where U turns are prohibited. The sign shall have a standardized size of 24 × 24 inches.

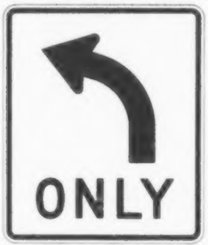


R3–4
24" x 24"

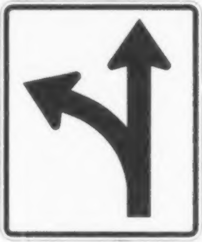
The word message NO U TURN, on a 24 × 30 inch panel, may be used as an alternate.

2B-17 Lane-Use Control Signs (R3-5 to 8)

Lane-Use Control signs shall be used where turning movements are required or where unconventional turning movements are permitted from specific lanes at an intersection. The standard size of these signs shall be 30 × 36 inches when mounted overhead, and 30 × 30 inches when post mounted. Signs for overhead mounting shall be mounted over the lanes to which they apply. The Mandatory Movement sign (R3-5) shall show a single arrow and the regulatory word message ONLY. The optional movement sign (R3-6) shall show a straight-through and a curved arrow with the lower ends of their shafts superimposed, to indicate that either of the movements symbolized is permissible. The letters "OK" may be added to the legend of the R3-6 sign. The optional movement sign (R3-6) shall not be used alone to effect a turn prohibition.

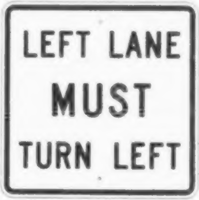


R3–5
30" x 36"

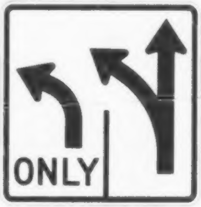


R3–6
30" x 36"

Both signs R3-5 and R3-6 are intended for overhead mounting only.



R3–7
30" x 30"



R3–8
30" x 30"

The mandatory turn sign (R3-7) designed for post mounting shall carry the message Right (or Left) Lane Must Turn Right (or Left).

The post-mounted double turn sign (R3-8) may be needed at such locations as at the right curb (for double right turns) or on the left side of a one-way street or on the median of a divided highway (for double left turns). The double-turn sign should carry, side by side on the same plate, two arrow symbols similar to the designs for the overhead signs. The letters OK may be added to the double turn portion of the legend for the R3-8 sign; however, when two mandatory movement arrows are displayed, the word ONLY should be used under each arrow.

2B-18 Application of Lane-Use Control Signs at Intersections

Lane-Use Control signs shall be used at intersections whenever it is desired to require vehicles in certain lanes to turn, or to permit turns from an adjacent lane. However, signs R3-5 and R3-7 are not required at signalized intersections where separate turn signals and turning bays are provided.

Lane-Use Controls permitting left (or right) turns from two (or more) lanes are normally warranted whenever the turning volume exceeds the capacity of one turning lane, and when all movements can be accommodated in the lanes available to them. When multiple-lane left turns are to be permitted at signalized intersections, special signal phasing should be used to allow the turning movements without interference from opposing or cross traffic.

Overhead Lane-Use Control signs are preferred because they can be placed over the lanes to which they apply. This type of control, and particularly the multiple-lane turn, occurs where volumes are high and an overhead installation can be justified. Use of an overhead sign for one approach lane does not require installation of overhead signs for the other lanes of that approach.

When post-mounted Lane-Use Control signs are used, one sign should be placed at the intersection. A second Lane-Use Control sign should be placed at an adequate distance in advance of the intersection so that motorists can select the appropriate lane before reaching the ends of the lines of waiting vehicles. Pavement markings (sec. 3B-17) may be used to supplement post-mounted signs and should be used with mandatory turn signs.

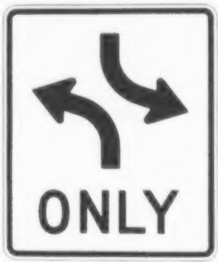
2B-19 Two Way Left Turn Only Signs (R3-9a, 9b)

Two-Way Left Turn Only signs (R3-9a or R3-9b) should be used in conjunction with the required pavement markings where a lane is reserved for the exclusive use of left turning vehicles in either direction and is not used for passing and overtaking. The post-mounted R3-9b sign may be used as an alternate to or a supplement to the overhead mounted R3-9a sign. **II-75(c) Rev. 4**

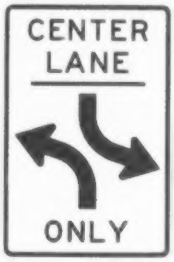
Signing is especially helpful to motorists in areas where the two-way left turn only maneuver is new, in areas subject to environmental conditions that frequently obscure the pavement markings, and on peripheral TWLTO streets to an extensive system of two-way left turn only routes.

II-75(c)
Rev. 4

The use of BEGIN or END at the top of a Two-Way Left Turn Only sign is permitted. The message may appear on the main sign itself, or on a plate mounted immediately above it.



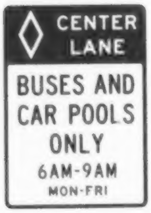
R3-9a
30″×36″


CENTER
LANE
ONLY

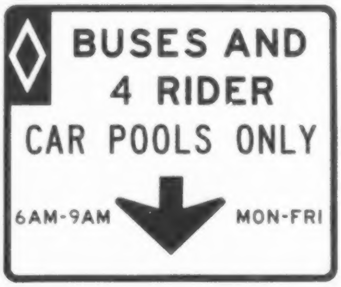
R3-9b
24″×36″

2B-20 Preferential Lane Signing (R3-10 to 15)

Preferential lanes are lanes where usage is limited according to class of vehicle occupancy. Signing for these lanes should follow the standard regulatory signing principles: black legend on white background, rectangular shape, and reflectorized or illuminated if applicable during periods of reduced visibility. The diamond lane marking symbol used to designate preferential lanes should be incorporated in the body of the signs, as a white symbol on a black background.


CENTER
LANE
BUSES AND
CAR POOLS
ONLY
6AM-9AM
MON-FRI

R3-11
30″×42″


BUSES AND
4 RIDER
CAR POOLS ONLY
6AM-9AM
MON-FRI

R3-14
72″×60″

Signs R3-11 (post-mounted) or R3-14 (overhead) are intended for use with a preferential lane to indicate the particular restrictions applying to that lane. When used, sign R3-11 should be located adjacent to the preferential lane and the R3-14 sign should be mounted directly over the lane. The message format of a Bus-Carpool lane for sign R3-11 should have the following sequence:

TOP LINES: lane(s) applicable (e.g., CENTER LANE, CURB LANE, RIGHT 2 LANES, THIS LANE)

MIDDLE LINES: applicable vehicles (e.g., BUSES ONLY, BUSES AND CARPOOLS, BUSES AND RIGHT TURNS ONLY)

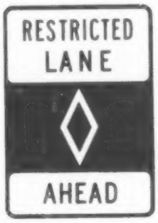
BOTTOM LINES: applicable time and day (e.g., 7-9 AM, 4-6 PM, MON-FRI).

The message format of sign R3-14 should have this sequence:

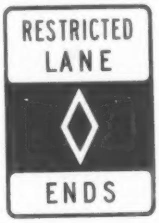
TOP LINES: applicable vehicles (e.g., BUSES ONLY, BUSES AND CARPOOLS, BUSES AND RIGHT TURNS ONLY)

BOTTOM LINES: applicable time and day (e.g., 7-9 AM, 4-6 PM, MON-FRI). The time and day are separated by a down arrow.

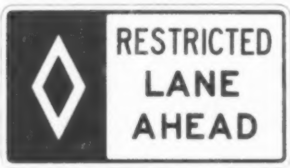
The diamond symbol on these signs preferably should appear in the top left quadrant.



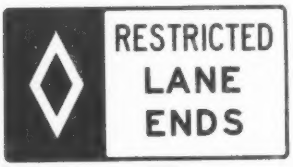
R3-10
30″ × 42″



R3-12
30″ × 42″



R3-13
66″ × 36″



R3-15
66″ × 36″

Where overhead lane-use control signals or changeable message signs are used to convey the preferential lane-use restrictions, signs R3-11 and R3-14 are not mandatory but may be used to supplement the other controls. The required pavement markings for these lanes are specified in section 3B-22.

Advance notification of preferential lane-use roadways is desirable. RESTRICTED LANE AHEAD signs, R3-10 for post mounting and R3-13 for overhead mounting, may be used for this purpose.

At the end of a signed section of preferential lanes, a RESTRICTED LANE ENDS sign (R3-12 or R3-15) shall be used.

Although the legend format of signs R3-10 through 15 should be retained, other messages may be used to fit a specific preferential lane-use operation. Sign size, location and spacing are dependent upon the individual situation, but should be consistently applied.

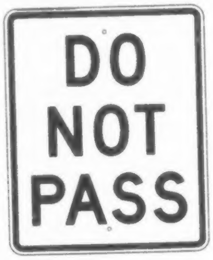
2B-21 Do Not Pass Sign (R4-1)

The DO NOT PASS sign may be used on a two- or three-lane road at the beginning of, and at intervals within a zone through which restricted sight distance or other condition makes overtaking and passing hazardous. Where standard pavement markings (sec. 3B-3) are present, the sign need not be used. However, the sign may be used in addition to the pavement markings to emphasize the restriction on passing.

The standard DO NOT PASS sign shall be 24 × 30 inches, with a minimum size for minor roads of 18 × 24 inches.

Because a driver about to pass a vehicle ahead often has only a restricted view to the right, consideration should be given to placing a sign on the left-hand side of the roadway. The NO PASSING ZONE sign (sec. 2C-38), placed on the left-hand side of two-way roadways, should be considered as a supplement to the enforceable no-passing zone control which is the regulatory marking and/or the regulatory signs.

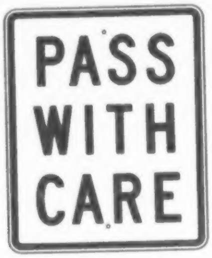
Standards for determining the location and extent of no-passing zones are set forth in connection with pavement markings through such zones (sec. 3B-4, 5).



R4-1
24" x 30"

2B-22 Pass With Care Sign (R4-2)

The PASS WITH CARE sign should be used at the end of a no-passing zone where a DO NOT PASS sign has been erected at the beginning of the zone. It shall be of the same size and erected in the same manner as the DO NOT PASS sign.

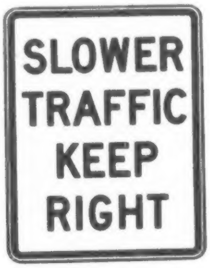


R4-2
24" x 30"

2B-23 Slower Traffic Keep Right Sign (R4-3)

The SLOWER TRAFFIC KEEP RIGHT sign may be used on multiple-lane roadways to reduce unnecessary weaving. It should be erected just beyond the beginning of a multiple-lane pavement, and at selected locations on the median strip of a divided highway where there is a tendency on the part of the motorist to drive in the left-hand lane (or lanes) below the normal speed of traffic. It should not be used on the approach to an interchange or through an interchange area.

This sign shall have a standard, and minimum, size of 24 × 30 inches. Because it is not used on secondary roads, no small design is provided. On expressways the sign should be at least 36 × 48 inches, with 48 × 60 inches prescribed for freeways.



R4-3
24" x 30"

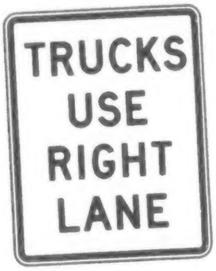
2B-24 Signs for Uphill Traffic Lanes (R4-5, R4-6)

Where an extra lane has been provided on an upgrade for slow-moving traffic, it should be preceded by a sign directing such traffic into this "climbing" lane. The SLOWER TRAFFIC KEEP RIGHT sign (sec. 2B-23) is applicable for this purpose, or more specific messages such as TRUCKS USE RIGHT LANE (R4-5) may be used. The standard, and minimum, size of these signs shall be 24 × 30 inches.

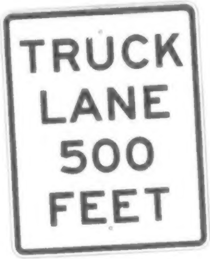
In advance of the beginning of the climbing lane a sign, TRUCK LANE (500) FEET (R4-6), may be erected, of the same size as the sign at the beginning of the climbing lane. The distance shown should approximate that of the actual location of the sign.

In advance of the end of the climbing lane, a Pavement Width Transition warning sign should be erected (sec. 2C-19). This is particularly important, as the end of the climbing lane will normally be concealed beyond the crest of the grade. A duplicate sign on the left of the roadway is also desirable to warn the faster traffic, as the sign on the right may be obscured by the slower moving trucks.

Pavement markings should clearly indicate how the climbing lane is designed to operate.



R4-5
24" x 30"

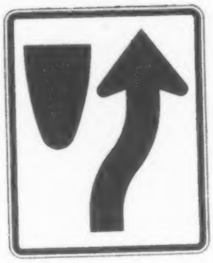


R4-6
24" x 30"

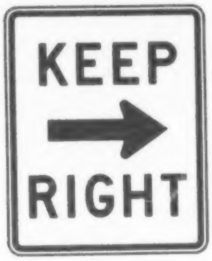
2B-25 Keep Right Sign (R4-7)

The Keep Right sign should be used at the ends of medians, parkways, loading islands, and refuge islands, at traffic islands, and at underpass piers, where traffic is required to keep to the right. The Keep Right sign may not always be necessary at intermediate ends of divisional islands and medians and should not be used with other signs that obviously mark locations where motorists know they must pass on the right. The word message KEEP RIGHT, with an arrow, on a 24 × 30 inch panel may be used as an alternate for the R4-7 sign.

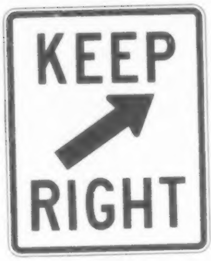
The Keep Right sign shall have a standard size of 24 × 30 inches. On expressways the sign should be at least 36 × 48 inches, with 48 × 60



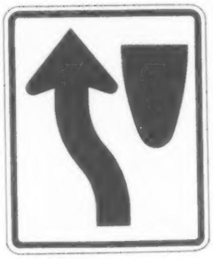
R4–7
24" x 30"



R4–7a
24" x 30"



R4–7b
24" x 30"



R4–8
24" x 30"

inches prescribed for use on freeways. A smaller size of 18 × 24 inches is permissible for use on narrow medians and at median openings to serve entering cross traffic and to remind through traffic of the regulation.

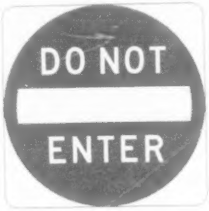
A certain amount of flexibility must be allowed in the mounting height for Keep Right signs. Where the obstruction is in or so near the lane of traffic that the sign at a normal minimum height may be obscured by vehicles, a second sign of the same design may be mounted directly above the standard sign with its bottom edge at a height of 8 to 10 feet above the pavement. In this case the lower sign may be placed somewhat below the normal minimum height.

On a median, the Keep Right sign should be mounted not more than 50 feet beyond the approach end of the island. On a pedestrian island or intersection channelizing island it should be mounted at the approach end or as close thereto as practicable. The sign should be mounted on the face of or just in front of a pier or other obstruction in the center of the roadway. Where appropriate, a Keep Left sign (R4-8) may be used (sec. 5E-2).

2B-26 Do Not Enter Sign (R5-1)

To prohibit traffic from entering a restricted road section the DO NOT ENTER sign should be conspicuously placed in the most appropriate position at the end of a one-way roadway or ramp. The sign should normally be mounted on the right-hand side of the roadway, facing traffic entering the roadway or ramp in the wrong direction. However, a second sign on the left-hand side of the roadway may be justified, particularly where traffic may be approaching in a turn.

The DO NOT ENTER sign shall be a 30-inch white square on which is inscribed a 29-inch diameter red circle, with a white band 5 inches in width placed horizontally across the center of the circle. The legend DO NOT ENTER shall appear in white letters with the words DO NOT above the band and ENTER below the band. Larger sizes are prescribed for use on major streets or on expressways with one-way ramp or roadway connections.

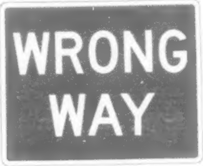


R5-1
30" x 30"

2B-27 Wrong Way Sign (R5-9)

The WRONG WAY sign (R5-9) may be used as a supplement to the DO NOT ENTER sign (R5-1) where an exit ramp intersects a crossroad or a crossroad intersects a divided highway in a manner that may invite wrong-way entry.

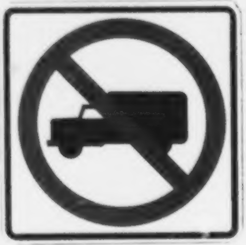
The sign should be placed at a location along the exit ramp or the divided roadway farther from the crossroad than the DO NOT ENTER sign.



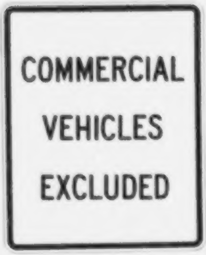
R5-9
36" x 24"

2B-28 Selective Exclusion Signs

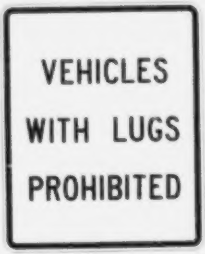
The laws of most States permit the State or local authority having jurisdiction to exclude trucks or other commercial vehicles from any designated highway where signs have been placed giving this notice. Sign legends should be developed to meet requirements established by statute or ordinance. The No Trucks symbol (R5-2), COMMERCIAL VEHICLES EXCLUDED (R5-4), and TRUCKS (VEHICLES) WITH LUGS PROHIBITED (R5-5) are suggested as suitably specific legends.



R5–2
24" x 24"



R5–4
24" x 30"



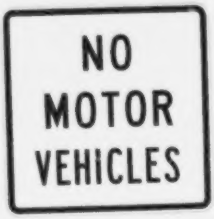
R5–5
24" x 30"

The word legend NO TRUCKS on a 24 × 24 inch panel may be used as an alternate.

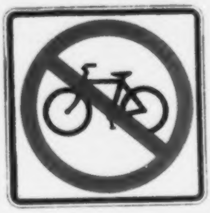
Most States provide that the proper authority may exclude pedestrians, bicycles, or other type traffic and shall erect signs setting forth such restrictions. To be effective such signs must clearly indicate the type of traffic that is admitted or the type that is excluded. Typical exclusion messages include No Bicycles (R5-6), NONMOTORIZED TRAFFIC PROHIBITED (R5-7), MOTOR-DRIVEN CYCLES PROHIBITED (R5-8) or an appropriate combination or grouping of these legends into a single sign, such as PEDESTRIANS BICYCLES MO-

best copy available

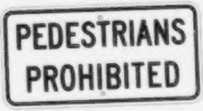
TOR-DRIVEN CYCLES PROHIBITED (R5-10a) or PEDESTRIANS AND BICYCLES PROHIBITED (R5-10b).


NO
MOTOR
VEHICLES

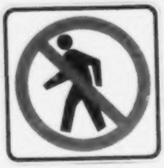
R5-3
24"×24"



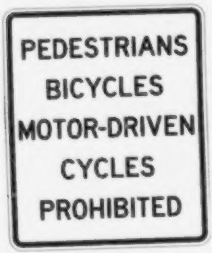
R5-6
24" x 24"


PEDESTRIANS
PROHIBITED

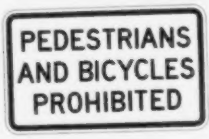
R5-10c
24"×12"



R9-3a
18"×18"


PEDESTRIANS
BICYCLES
MOTOR-DRIVEN
CYCLES
PROHIBITED

R5-10a
30"×36"


PEDESTRIANS
AND BICYCLES
PROHIBITED

R5-10b
30"×18"

If an exclusion is to be governed by vehicle weight, a Weight Limit sign (sec. 2B-41) rather than an Exclusion sign should be used.

Because of the variety of possible messages for these signs, it is not practicable to fix standard sizes for them as a class. In all cases the lettering should be large enough to give adequate legibility. They should be conspicuously placed at all entrances to the restricted roadway.

The Exclusion sign should be placed on the right-hand side of the roadway approximately 25 feet from the intersection so as to be clearly visible to all drivers and others turning into the roadway which has the exclusion. A supplementary sign may be necessary on the left-hand side of the restricted roadway.

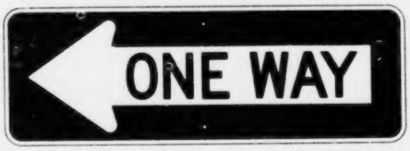
A PEDESTRIAN PROHIBITED sign (R5-10c) should be used at interchanges or elsewhere where pedestrians can enter the expressway right-of-way and endanger themselves or others, particularly where they attempt to cross the roadways. The sign may also be used at underpasses or elsewhere where safe pedestrian facilities are not provided. The sign should be erected wherever it can be most effective. Because of the length of the words constituting its legend, a 24 × 12 inch horizontal panel is warranted.

2B-29 One Way Sign (R6-1, R6-2)

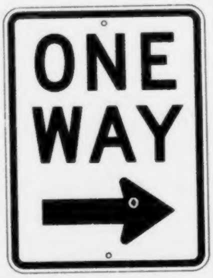
The ONE WAY sign shall be used when required to indicate streets or roadways upon which vehicular traffic is allowed to travel in one direction only. The sign shall be either (a) a white arrow, right or left, on black horizontal rectangle of a standard, and minimum, size of 36 × 12 inches with the words ONE WAY centered in the arrow (R6-1); or (b) a vertical rectangle of a standard, and minimum, size of 18 × 24 inches with black lettering and a right or left arrow on a white background (R6-2). The vertical design has advantages where lateral space is limited.

One Way signs shall be placed on the near right-hand and the far left-hand corners of the intersection at nonsignalized intersections so as to face traffic entering or crossing the one-way street (Figure 2-3, page 2A-11), except that intersections of divided highways with median widths of 30 feet or more may be signed as in Section 2A-31. Where the intersection is signalized, the signs shall be placed either near the appropriate signal faces or at the locations specified for nonsignalized intersections. One Way signs should also be placed parallel to the one-way street directly opposite the exits from alleys and other public ways. A One Way sign should always be used, where applicable, and may be supplemented by a Turn Prohibited sign (sec. 2B-15).

II-10 (c)
II-58 (c)
Rev. 3



R6-1
36" x 12"



R6-2
18" x 24"

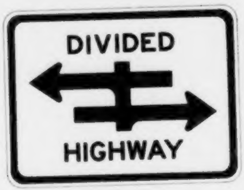
One Way signs are not ordinarily needed on the one-way roadways of divided expressways, where the design of interchanges indicates the direction of traffic on the separate roadways.

2B-30 Divided Highway Crossing Sign (R6-3, R6-3a)

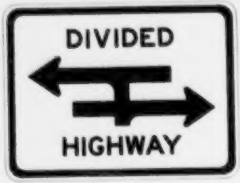
The Divided Highway Crossing sign may be used as a supplemental sign on the approach legs of a roadway that intersects with a divided highway.

The sign may be placed beneath a stop sign or mounted separately.

When the Divided Highway Crossing sign is used at a four-legged intersection, sign R6-3 shall be used. When used at a "T" intersection, sign R6-3a shall be used. The standard and minimum size sign in 24'' by 18''.



R6-3
24''×18''



R6-3a
24''×18''

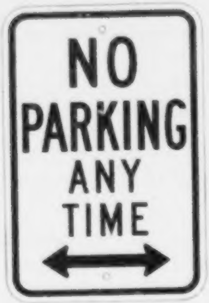
2B-31 Urban Parking and Stopping Signs (R7 Series)

Parking signs and other signs governing the stopping and standing of vehicles cover a very wide variety of regulations and only general specifications can be laid down here. Typical examples are as follows:

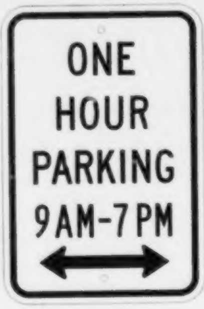
NO PARKING ANY TIME (R7-1)
NO PARKING 8:30 AM to 5:30 PM (R7-2)
NO PARKING EXCEPT SUNDAYS AND HOLIDAYS (R7-3)
NO STANDING ANY TIME (R7-4)
ONE HOUR PARKING 9 AM-7 PM (R7-5)
NO PARKING LOADING ZONE (R7-6)
NO PARKING BUS STOP (R7-7, R7-107, R7-107a)

Many other wordings will be found necessary to fit local conditions. To minimize the number of parking signs, blanket regulations that apply to a given district may, if legal, be posted at municipal boundary lines. School area parking signs are treated in Part VII of this Manual.

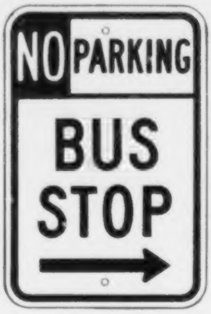
The legend on parking signs shall state whatever regulations apply, but the signs shall conform to the standards of shape, color, location and


NO
PARKING
ANY
TIME

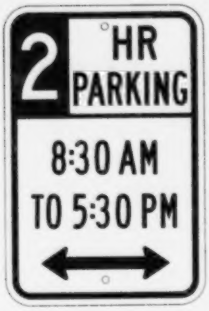
R7-1
12" x 18"


ONE
HOUR
PARKING
9 AM-7 PM

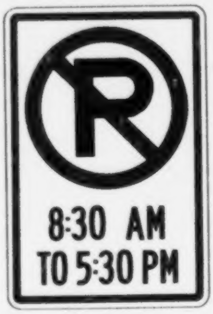
R7-5
12" x 18"


NO PARKING
BUS
STOP

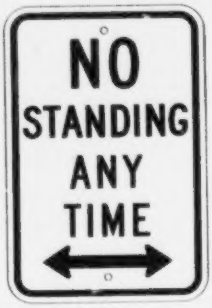
R7-107
12" x 18"


2 HR
PARKING
8:30 AM
TO 5:30 PM

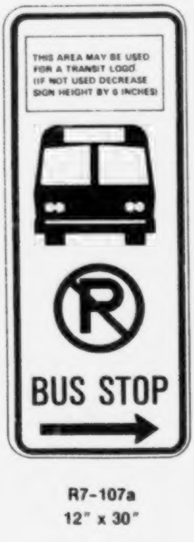
R7-108
12" x 18"


R
8:30 AM
TO 5:30 PM

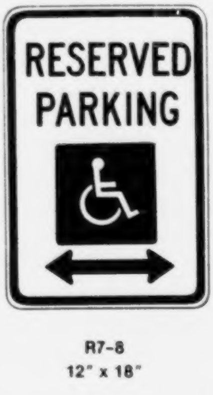
R7-2a
12" x 18"


NO
STANDING
ANY
TIME

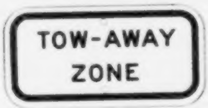
R7-4
12" x 18"


THIS AREA MAY BE USED
FOR A TRANSIT LOGO
(IF NOT USED DECREASE
SIGN HEIGHT BY 6 INCHES)
R
BUS STOP

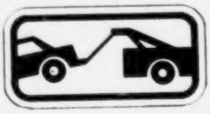
R7-107a
12" x 30"


RESERVED
PARKING

R7-8
12" x 18"


TOW-AWAY
ZONE

R7-201
12" x 6"



R7-201a
12" x 6"

use. Generally, parking signs should display such of the following information as is appropriate, from top to bottom of the sign, in the order listed:

1. Restriction or prohibition.
2. Time of day it is applicable, if not at all hours.
3. Days of week applicable, if not every day.

In addition there should be a single-headed arrow pointing in the direction the regulation is in effect, if the sign is at the end of a zone, or a double-headed arrow pointing both ways, if the sign is at an intermediate point in a zone. As an alternate to the arrow, if the signs are posted facing traffic at an angle of 90 degrees to the curb line, there may be included on the sign, or on a separate plate below the sign, such legend as BEGIN, END, HERE TO CORNER, HERE TO ALLEY, THIS SIDE OF SIGN, or BETWEEN SIGNS.

Where parking is prohibited at all times or at specified times, parking signs shall have red letters and border on a white background (Parking Prohibition signs). Where only limited-time parking or parking in a particular manner are permitted, the signs shall have green letters and borders (Parking Restriction signs).

In signs R7-107 and 108, the word NO or the numeral showing the time limit in hours or minutes is presented in a reversed color arrangement in the upper left-hand corner, for emphasis. These two signs should be limited to using the word PARKING rather than STOPPING or STANDING so that the proper size and series of letters need not be sacrificed.

Alternate designs for the R7-107 sign are permissible (R7-107a). Alternate designs may include, on a single panel, a transit logo, an approved bus symbol, a parking prohibition, the words BUS STOP, and an arrow. The preferred bus symbol color is black but other dark colors may be used. Additionally, the transit logo may be shown on the bus face in the appropriate colors in lieu of placing the logo separately. The reverse side of the sign may contain bus routing information.

Where parking is prohibited during certain hours and permitted under a time limit at other periods of the day, two parking signs should ordinarily be used, the red above the green. As an alternative both messages, in different colors may be used on a single plate, with the sign lengthened vertically if necessary.

On urban streets parking signs shall have a standard, and minimum, size of 12 × 18 inches and need not be reflectorized.

At the transition point between two parking zones it may be advantageous to use, instead of two signs, a single sign 21 × 18 inches. This is in effect two standard signs mounted side by side. Such a sign should display a right and a left arrow pointing in the directions that the respective restrictions apply.

Where it is essential that all traffic lanes be kept open for moving traffic, some city authorities make it a practice to tow away illegally parked vehicles. To make the parking regulations more effective and to improve public relations by giving a definite warning, a sign reading TOW-AWAY ZONE (R7-201) may be appended to, or incorporated in, any parking prohibition sign. It should have red legend on a white background. The Tow-Away Zone Symbol sign (R7-201a) may be used in lieu of the R7-201 sign.

Where special parking restrictions are imposed during heavy snowfall, Snow Emergency signs may be erected. The legend will vary according to the regulations, but the signs shall be vertical rectangles, having a white background with the upper part of the plate a red background.

The words NO PARKING may be used as an alternative to the No Parking symbol (shown in sign R8-3a) on signs R7-1, R7-2, R7-3, R7-6, R7-7, and R7-107a. When the symbol sign itself (R8-3a) is used for urban applications, it shall have a minimum and standard size of 24 inches square. The symbol "P" is black, circumscribed in a red circle with a red slash on a white background and black border.

The supplemental educational plaque, NO PARKING, with a red legend and border on a white background, may be used above the symbol.

2B-32 Placement of Urban Parking Signs

When parking signs with arrows are used to indicate the extent of the restricted zones, the signs should be set at an angle of not less than 30 nor more than 45 degrees with the line of traffic flow to be visible to approaching traffic.

Care should be exercised to see that the single arrows point in the proper direction to indicate the regulated zone. Where the zone is unusually long, signs showing a double arrow are desirable at intermediate points within the zone.

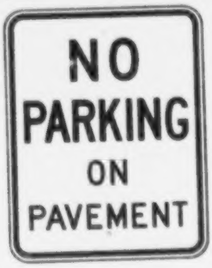
If the signs are mounted at an angle of 90 degrees to the curb line, two signs shall be mounted back to back at the transition point between two parking zones, each with the appended plate reading THIS SIDE OF SIGN. At intermediate points within a zone, a single sign without any arrow or appended plate should be used, facing in the direction of approaching traffic. Otherwise the standards of placement should be the same as for signs using directional arrows.

2B-33 Parking Prohibition Signs in Rural District (R8-1, 2, 3, 5, 6)

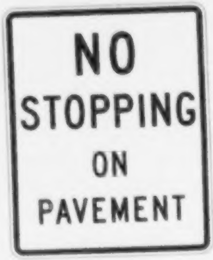
In rural districts, special parking prohibition signs may be used to emphasize that no person shall stop, park, or leave standing any vehicle on the paved or traveled part of the highway. Rural parking prohibition signs shall have a red legend on a white background.

The legend on rural parking signs must be appropriate to the restrictions imposed. The legend NO PARKING ON PAVEMENT (R8-1) is generally suitable. Where a roadway has paved shoulders, the NO PARKING EXCEPT ON SHOULDER (R8-2) is less likely to cause confusion. The simple legend, NO PARKING (R8-3) prohibits any parking along a given highway. However, if the restriction applies to a limited area or zone, the limits of the zone should be shown by arrows or supplemental plates as used on urban parking signs. If necessary, the word STOPPING may be substituted for PARKING.

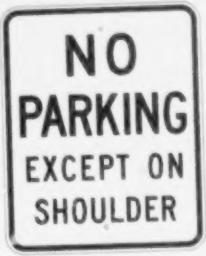
The standard size for rural parking signs shall be 24 × 30 inches. On secondary roads a smaller size of 18 × 24 inches is permitted. Expressway parking signs should be at least 36 × 48 inches.


NO
PARKING
ON
PAVEMENT

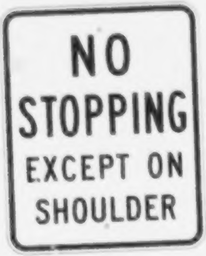
R8–1
24" x 30"


NO
STOPPING
ON
PAVEMENT

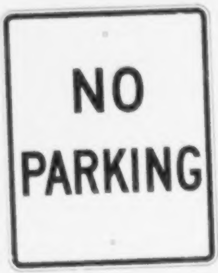
R8–5
24" x 30"


NO
PARKING
EXCEPT ON
SHOULDER

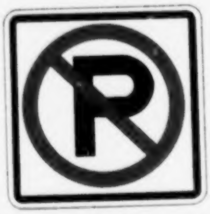
R8–2
24" x 30"

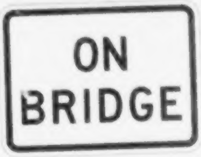

NO
STOPPING
EXCEPT ON
SHOULDER

R8–6
24" x 30"



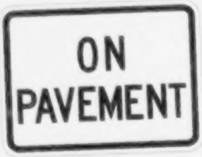
R8–3
24" x 30"





R8-3a
24"×24"

Supplemental Plate
24"×18"


ON
PAVEMENT

Supplemental Plate
24"×18"

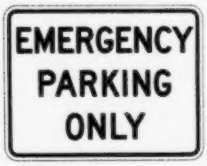
The words NO PARKING may be substituted for the No Parking symbol on signs R8-1, R8-2, and R8-3. Or, symbol sign R8-3a may be used, with any accompanying word message to appear on a separate supplemental plate mounted below the symbol plate. For rural applications, sign R8-3a shall have a minimum and standard size of 24 inches square. The supplemental plate shall conform to the width of the symbol plate, but the length should vary depending upon the length of the legend used. The legend and border shall have a red color with a white background.

A supplemental educational plaque, NO PARKING, with a red legend and border on a white background, may be used above the symbol.

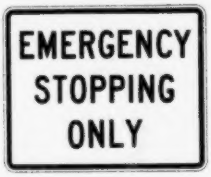
2B-34 Emergency Parking Signs (R8-4, 7)

Stopping of vehicles on expressways can be exceedingly hazardous. If an emergency stop is necessary, it should be made on the shoulder, well off the pavement. Except where adequate paved turnouts are provided, the road shoulders should be reserved for emergency use by vehicles that must leave the roadway to stop because of mechanical breakdown, tire trouble, lack of fuel, or other emergencies involving the vehicles or their occupants.

The EMERGENCY PARKING ONLY sign (R8-4) may be used on expressways a short distance beyond an interchange entrance and at random intervals as needed, particularly where scenic or other attractions create a tendency to stop temporarily, and no turnout or rest areas have been provided. If necessary the word STOPPING (R8-7) may be substituted for PARKING. These signs are designed as horizontal rectangles as shown below and shall have a black legend on a white background. A size of 48 × 36 inches is prescribed for use on freeways.



R8-4
30" x 24"



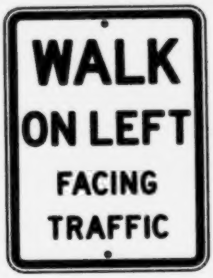
R8-7
30" x 24"

2B-35 Walk on Left and No Hitchhiking Signs (R9-1, 4)

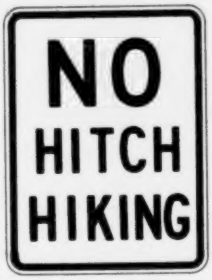
The pedestrian sign WALK ON LEFT FACING TRAFFIC may be used to encourage safer pedestrian habits on rural highways where no sidewalks are provided. This sign shall be in only one standard size of 18 × 24 inches, and need not be reflectorized. It should be erected on the right-hand side of the road where pedestrians must walk on the pavement or road shoulder in the absence of pedestrian pathways or sidewalks.

The No Hitchhiking sign may be used to post prohibition against standing in the roadway for the purpose of soliciting a ride. It may be erected at locations where hitchhiking has been observed contrary to law. The R9-4 word message sign may be used as an alternate to the R9-4a symbol sign.

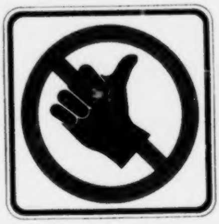
Editorial Change Rev. 2



R9–1
18" x 24"



R9–4
18" x 24"



R9-4a
18" × 18"

Editorial Change Rev. 3

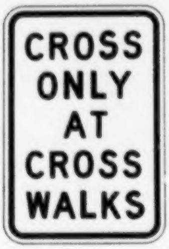
2B-36 Pedestrian Crossing Signs (R9-2, R9-3)

Pedestrian Crossing signs may be used selectively to aid in limiting pedestrian crossing to safe places. They will ordinarily be required only in urban areas and, when used, shall be erected to face the traffic for which they are intended. The messages shown are typical. These signs need not be reflectorized.

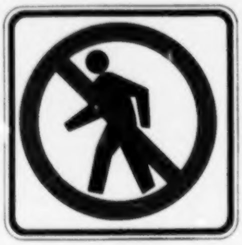
Editorial Change Rev. 2

The CROSS ONLY AT CROSS WALKS sign (R9-2) may be used, where crosswalks are clearly defined, to discourage jay-walking or unauthorized crossing.

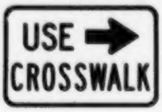
The No Pedestrian Crossing sign may be used to prohibit pedestrians from crossing a roadway at a point which is considered to be hazardous, especially in front of a school or other public building where a crossing is not designated. The R9-3 word message sign may be used as an alternate to the R9-3a symbol sign. Supplemental black on white panel R9-3b (R or L), USE CROSSWALK with an arrow, may be used below either sign to designate the direction of the crossing. When R9-3b is used, the educational plaque for R9-3a should be deleted.



R9-2
12" x 18"



R9-3a
18" × 18"



R9-3b
18" × 12"

2B-37 Traffic Signal Signs (R10-1 to 12)

To supplement traffic signal control, auxiliary signs of the type illustrated are often desirable or necessary for the instruction of pedestrians and drivers. Signal instruction signs should be located adjacent to the signal face to which they apply.

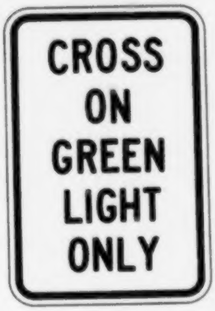
Among the traffic signal instruction signs applicable to pedestrians are signs R10-1, 2, 3, and 4. These signs need not be reflectorized.

Permissible as an alternate message for the Pedestrian Actuated Signal sign (R10-3, R10-4) is the legend TO CROSS STREET (arrow) PUSH BUTTON WAIT FOR GREEN (WALK) SIGNAL (R10-3a, R10-4a). The symbol sign R10-4b may also be used as an alternate to sign R10-4. II-55(c) Rev. 4

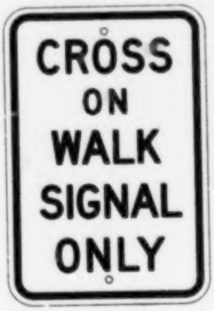
The Pedestrian Actuated Signal sign should be 9 × 12 inches in size and shall be mounted immediately above or incorporated in the pedestrian push-button unit (sec. 4D-6).

Signal instruction signs may be needed at certain locations to clarify signal control. Among the legends for this purpose are LEFT ON ARROW ONLY (R10-5), LEFT TURN YIELD ON GREEN (symbolic green ball) (R10-12), or LEFT (RIGHT) TURN SIGNAL (R10-10) for compliance with certain turn signals, STOP HERE ON RED (R10-6) for observance of signal limit lines, DO NOT BLOCK INTERSECTION (R10-7) for avoidance of traffic obstructions, and USE LANE(S) WITH GREEN ARROW (R10-8) for obedience to lane-direction control signals. II-31 (c) Rev. 3

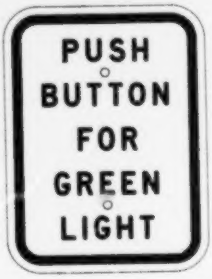
The NO TURN ON RED sign (R10-11a, 11b) shall be used to indicate that a right turn on red (or left turn on red for one-way streets) is not permitted. For part time prohibitions see section 2B-15. The NO TURN ON RED sign should have standard dimensions of 24 × 30 inches and 24 × 24 inches for R10-11a and R10-11b, respectively. The sign should be erected near the appropriate signal head.


CROSS
ON
GREEN
LIGHT
ONLY

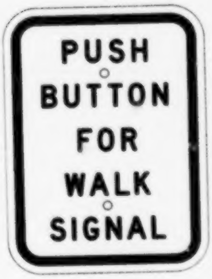
R10–1
12" x 18"


CROSS
ON
WALK
SIGNAL
ONLY

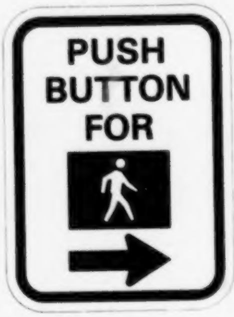
R10–2
12" x 18"


PUSH
BUTTON
FOR
GREEN
LIGHT

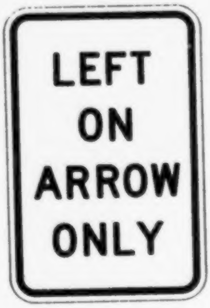
R10–3
9" x 12"


PUSH
BUTTON
FOR
WALK
SIGNAL

R10–4
9" x 12"


PUSH
BUTTON
FOR

R10-4b
9" x 12"


LEFT
ON
ARROW
ONLY

R10–5
12" x 18"

II-55 (c)
Rev. 4

A NO TURN ON RED sign may be considered whenever an engineering study finds that one or more of the following conditions exist:

1. Sight distance to vehicles approaching from the left (or right, if applicable) is inadequate.

2. The intersection area has geometrics or operational characteristics which may result in unexpected conflicts.

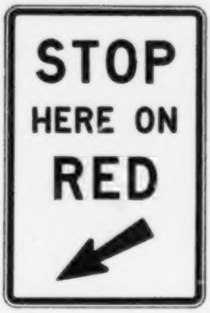
3. There is an exclusive pedestrian phase.

4. Significant pedestrian conflicts are resulting from RTOR maneuvers.

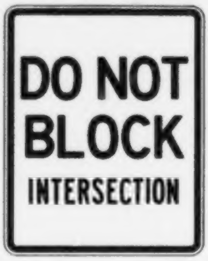
5. More than three RTOR accidents per year have been identified for the particular approach.

6. There is significant crossing activity by children, elderly, or handicapped people.

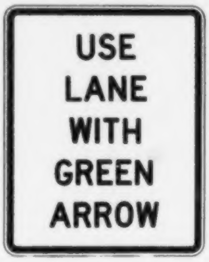
Where improved utilization of progressive signal systems is desired, the Traffic Signal Speed sign (sec. 2D–48) should be used.


STOP
HERE ON
RED

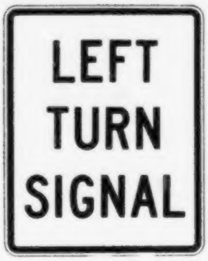
R10-6
24" x 36"


DO NOT
BLOCK
INTERSECTION

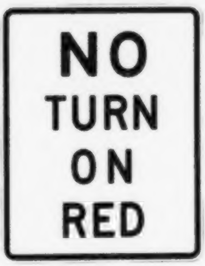
R10-7
24" x 30"


USE
LANE
WITH
GREEN
ARROW

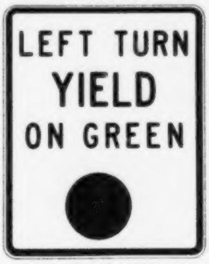
R10-8
24" x 30"


LEFT
TURN
SIGNAL

R10-10
24" x 30"


NO
TURN
ON
RED

R10-11a
24"×30"


LEFT TURN
YIELD
ON GREEN

R10-12
24" × 30"

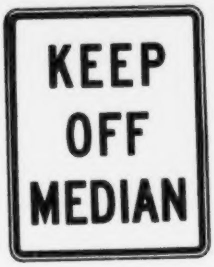
2B-38 Keep Off Median Sign (R11-1)

The Keep Off Median sign is intended for use where driving into or parking on the median is prohibited.

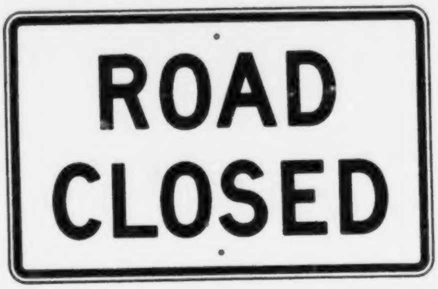
The KEEP OFF MEDIAN sign shall have a standard, and mimimum, size of 24 × 30 inches. On expressways it should be at least 36 × 48 inches, with 48 × 60 inches prescribed for freeways.

The sign should be erected on the left of the roadway within the median wherever there is a tendency for drivers to enter or cross and at random intervals as needed.

The sign should be erected on the left of the roadway within the median wherever there is a tendency for drivers to enter or cross and at random intervals as needed.



R11-1
24" x 30"



R11-2
48" x 30"

2B-39 Road Closed Sign (R11-2)

The ROAD CLOSED sign should be used to mark roads that have been closed to all traffic (except authorized vehicles) either because of construction or maintenance operations (Part VI) or because of a temporary emergency. It should not be used where traffic is maintained or where a route is detoured several miles in advance of the actual construction or blockade. In the latter case the Local Traffic Only sign (sec. 2B-40) should be used.

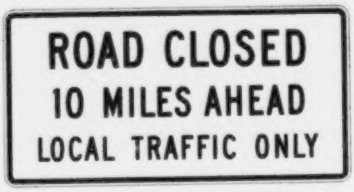
The Road Closed sign shall have a standard, and minimum, size of 48 × 30 inches.

Where the sign faces through traffic, it shall be preceded by an Advance Road Closed warning sign (sec. 6B-17) and, if applicable, an Advance Detour warning sign (sec. 6B-16).

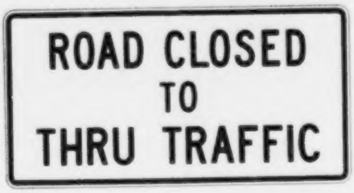
2B-40 Local Traffic Only Sign (R11-3, R11-4)

The Local Traffic Only sign should be used where through traffic must detour to avoid a closing of the highway for construction or maintenance work (Part VI), or for a temporary emergency some distance beyond, but where the highway is open for traffic up to the point of closure. It shall carry the legend ROAD CLOSED (10) MILES AHEAD—LOCAL TRAFFIC ONLY, or optionally for urban application, ROAD CLOSED TO THRU TRAFFIC. Both signs shall be designed as horizontal rectangles.

The words BRIDGE OUT (or similar message) may be substituted for ROAD CLOSED where applicable. Where the sign faces through traffic, it shall be preceded by an Advance Road Closed warning sign



R11-3
60" x 30"



R11-4
60" x 30"

2B-41 Weight Limit Signs (R12-1 to 5)

Due to seasonal weakening of the road surface, obsolescence of bridges or pavements, or other impairment of roadways, it is often necessary to limit the load permitted on a roadway.

The Weight Limit sign (R12-1) carrying the legend WEIGHT LIMIT (10) TONS, may be used to indicate restrictions pertaining to total vehicle weight including load.

Where the restriction applies to axle weight rather than gross load, the legend may be AXLE WEIGHT LIMIT (5) TONS (R12-2).

In residential districts, where it is intended to restrict trucks of certain sizes by reference to empty weight, the legend may read NO TRUCKS OVER 7000 LBS EMPTY WT (R12-3).

In areas where multiple regulations of the type described above are applicable, a sign combining the necessary messages on a single panel may be used, such as WEIGHT LIMIT (2) TONS PER AXLE (10) TONS GROSS (R12-4).

Posting of specific load limits may be accomplished by use of the Weight Limit symbol sign (R12-5). This sign contains the legend WEIGHT LIMIT on the top two lines and shows three different truck symbols with the allowable weight limit shown to the right of each symbol as ( ) T. A bottom line of legend stating GROSS WT is permissible if needed for enforcement purposes. Only the truck symbols and their respective weight limits for which restrictions apply need be shown.

A Weight Limit sign shall be located immediately in advance of the section of highway or the structure to which it applies. To reduce costly delay and backtracking, a weight limit sign (R12-1) with an advisory message may be placed at approach road intersections or other points where the affected vehicle can detour or turn around. The standard, and minimum, size shall be 24 × 30 inches but a larger size is desirable on major roads and streets.

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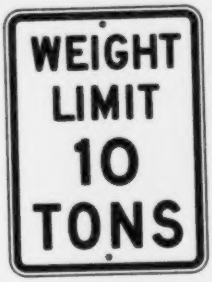
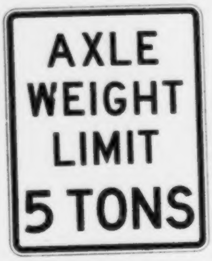
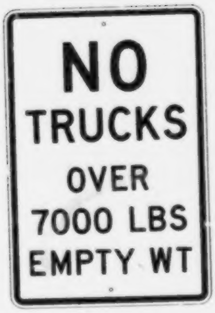

WEIGHT
LIMIT
10
TONS

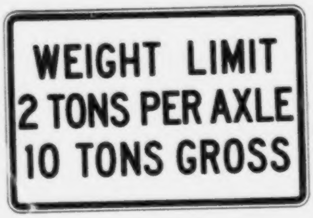
R12-1
24" x 30"


AXLE
WEIGHT
LIMIT
5 TONS

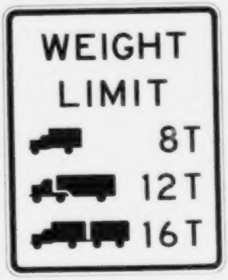
R12-2
24" x 30"


NO
TRUCKS
OVER
7000 LBS
EMPTY WT

R12-3
24" x 36"


WEIGHT LIMIT
2 TONS PER AXLE
10 TONS GROSS

R12-4
36" x 24"

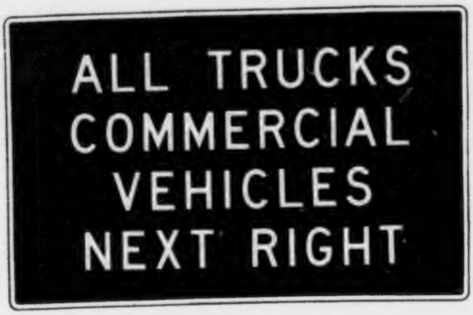

WEIGHT
LIMIT
8T
12T
16T

R12-5
30" × 36"

2B-42 Weigh Station Signs (R13 Series)

The laws of many States provide for the establishment of Weigh Stations at ports of entry and elsewhere, and require that trucks and other classes of vehicles shall stop at these stations for weighing, inspection, and clearance. A regulatory sign is usually necessary to direct the concerned traffic into the Weigh Station. When so required, the message ALL TRUCKS/COMMERCIAL VEHICLES/NEXT RIGHT (R13-1) is recommended. This sign should be supplemented by a series of guide signs standardized for the identification and operation of Weigh Stations (sec. 2D-45).

Although the standard regulatory sign color combination is a black legend on a white background, the reverse color combination, white legend on black background, is preferred for this sign.

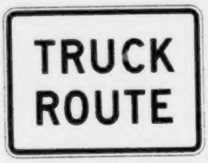


R13-1
72″×48″

2B-43 Truck Route Sign (R14-1)

The TRUCK ROUTE sign (R14-1) should be used to mark an unnumbered truck route which has been designated by proper authority where either a weight limit restriction or a truck exclusion has been imposed on alternate routes.

On a numbered highway, the auxiliary TRUCK marker (sec. 2D-20) will be applicable.



R14-1
24″ x 18″

2B-44 Other Regulatory Signs

Regulatory signs other than those classified and specified in this Manual may be required to aid the enforcement of other laws or regulations.

Typical miscellaneous regulatory signs are KEEP OFF WET PAINT, NO DUMPING ALLOWED, DO NOT THROW LITTER, NO FISHING FROM BRIDGE, and EMERGENCY AND AUTHORIZED VEHICLES ONLY, the uses of which are sufficiently obvious to require no detailed specifications. Care should be taken to avoid the use of special signs whenever a standard sign will serve the purpose.

PART II—C
Warning Signs

C. WARNING SIGNS

2C-1 Application of Warning Signs

Warning signs are used when it is deemed necessary to warn traffic of existing or potentially hazardous conditions on or adjacent to a highway or street. Warning signs require caution on the part of the vehicle operator and may call for reduction of speed or a maneuver in the interest of his own safety and that of other vehicle operators and pedestrians. Adequate warnings are of great assistance to the vehicle operator and are valuable in safe-guarding and expediting traffic. The use of warning signs should be kept to a minimum because the unnecessary use of them to warn of conditions which are apparent tends to breed disrespect for all signs.

Even on the most modern expressways there may be some conditions to which the driver can be alerted by means of warning signs. These conditions are in varying degrees common to all highways, and existing standards for warning signs are generally applicable to expressways.

Typical locations and hazards that may warrant the use of warning signs are:

1. Changes in horizontal alignment
2. Intersections
3. Advance warning of control devices
4. Converging traffic lanes
5. Narrow roadways
6. Changes in highway design
7. Grades
8. Roadway surface conditions
9. Railroad crossings
10. Entrances and crossings
11. Miscellaneous

Warning signs specified herein cover most conditions that are likely to be met. Special warning signs for highway construction and maintenance operations, school areas, railroad grade crossings and bicycle facilities are dealt with in Parts VI through IX of this Manual. If other warnings are needed, the signs shall be of standard shape and color for warning signs, and the legends shall be brief and easily understood.

The determination of the sign or signs to be erected shall be on the basis of an engineering study using the following sections as guidelines.

2C-2 Design of Warning Signs

Generally, all warning signs in this Part shall be diamond-shaped (square with one diagonal vertical) with black legend and border on a yellow background. There are specific exceptions to this rule, some of which are noted in the following sections. The allowance of these exceptions shall not be construed as permitting deviations from the standard messages where standard messages are applicable.

All warning signs having significance during the hours of darkness shall have a fully reflectorized background or be illuminated.

The standard size for each warning sign prescribed herein is shown with the illustration accompanying the specification. Where conditions of speed, volume, or special hazard require greater visibility or emphasis, larger signs should be used, with symbol or legend enlarged approximately in proportion to outside dimensions. Sign sizes for various type facilities can be found in Standard Highway Signs.*

To carry proper emphasis among large signs for other purposes, all warning signs on expressways should be not less than 36 × 36 inches.

To permit the use of standard dies and templates the outside dimensions of warning sign should ordinarily be in multiples of 6 inches. Letter heights should be rounded to the nearest inch that will best fit the plate used for legibility and appearance.

For use of educational plaques with symbol signs see section 2A-13.

2C-3 Placement of Warning Signs

Warning signs shall be erected in accordance with the general requirements for sign position as described in Section 2A-21 to 29.

Since warning signs are primarily for the benefit of the driver who is unacquainted with the road, it is very important that care be given to the placement of such signs. Warning signs should provide adequate time for the driver to perceive, identify, decide, and perform any necessary maneuver. This total time to perceive and complete a reaction to a sign is the sum of the times necessary for Perception, Identification/understanding, Emotion/decisionmaking, and Volition/execution of decision, and is here referred to as the PIEV time. The PIEV time can vary from about 3 seconds for general warning signs to 10 seconds for high driver judgment condition warning signs. Table II-1 lists suggested minimum sign placement distances that may be used for three conditions: II-4 (c)

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* Available from GPO, see page ii.

TABLE II-1—A Guide For Advance Warning Sign Placement Distance[1]

Posted or 85 percentile speed MPH	Condition A high judgment needed[3] (10 secs. PIEV)	General warning signs[3]					
		Condition B—Stop condition	Condition C—Deceleration condition to listed advisory speed—MPH (or desired speed at condition)				
		0	10	20	30	40	50
20	[5] 175	([4])	([4])				
25	250	([4])	[5] 100				
30	325	[5] 100	150	[5] 100			
35	400	150	200	175			
40	475	225	275	250	[5] 175		
45	550	300	350	300	250		
50	625	375	425	400	325	[5] 225	
55	700	450	500	475	400	300	
60	775	550	575	550	500	400	[5] 300

Typical Signs for the Listed Conditions in Table II-1; Condition A—Merge. Right Lane Ends, etc; Condition B—Cross Road, Stop Ahead, Signal Ahead, Ped-Xing, etc.; Condition C—Turn, Curve, Divided Road, Hill, Dip, etc.

1 Distances shown are for level roadways. Corrections should be made for grades. If 48-inch signs are used, the legibility distance may be increased to 200 feet. This would allow reducing the above distance by 75 feet.

2 In urban areas, a supplementary plate underneath the warning sign should be used specifying the distance to the condition if there is an in-between intersection which might confuse the motorist.

3 Distance provides for 3-second PIEV, 125 feet Sign Legibility Distance, Braking Distance for Condition B and Comfortable Braking Distance for condition C as indicated in *A Policy on Geometric Design of Highways and Streets*, 1984, AASHTO, Figure II-13.

4 No suggested minimum distance provided. At these speeds, sign location depends on physical conditions at site.

5 Feet

II-4 (c)

Condition A—a higher driver judgment condition which requires the driver to use extra time in making and executing a decision because of a complex driving situation; i.e., lane changing, passing, or merging. Condition B—a condition in which the driver will likely be required to stop; and Condition C—a condition in which the driver will likely be required to decelerate to a specific speed. The table is provided as an aid for determining warning sign location. The values contained in the table are for guidance purposes and should be applied with engineering judgment. The placement of temporary warning signs used at highway construction and maintenance sites is covered in Part VI of this Manual and the suggested minimum sign placement distances given in Table II-1 may not apply to that group of signs.

Other miscellaneous warning signs that advise of potential hazards not related to a specific location may be installed in the most appropriate locations since they are not covered in Table II-1. These include DEER CROSSING and SOFT SHOULDER signs. Minimum spacing between warning signs with different messages normally should be based on the PIEV times for driver comprehension and reaction.

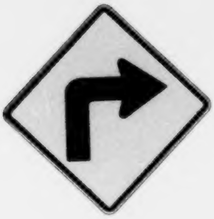
The effectiveness of the placement of any warning sign should be tested periodically under both day and night conditions. Figure 2-5 (page 2A-17) shows typical installations of standard warning signs.

2C-4 Turn Sign (W1-1)

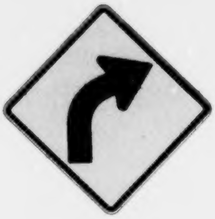
The Turn sign (W1-1R or 1L) is intended for use where engineering investigations of roadway, geometric, and operating conditions show the

INTENTIONALLY LEFT BLANK

recommended speed on a turn to be 30 MPH or less, and this recommended speed is equal to or less than the speed limit established by law or by regulation for that section of highway. Where a Turn sign is warranted, a Large Arrow sign (sec. 2C-9) may be used on the outside of the turn. Additional protection may be provided by use of the Advisory Speed plate (sec. 2C-35).



W1-1R
30" x 30"



W1-2R
30" x 30"

2C-5 Curve Sign (W1-2)

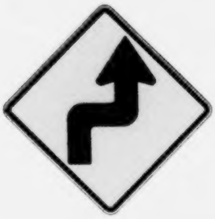
The Curve sign (W1-2R or 2L) may be used where engineering investigations of roadway, geometric, and operating conditions show the recommended speed on the curve to be greater than 30 miles per hour and equal to or less than the speed limit established by law or by regulation for that section of highway. Additional protection may be provided by use of the Advisory Speed plate (sec. 2C-35).

Editorial Change Rev. 4

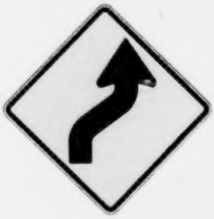
2C-6 Reverse Turn Sign (W1-3)

The Reverse Turn sign is intended for use to mark two turns or a curve and a turn in opposite directions as defined in the warrants for Turn and Curve signs (secs. 2C-4 and 5) that are separated by a tangent of less than 600 feet. If the first turn is to the right, a Right Reverse Turn sign(W1-3R) shall be used and if the first turn is to the left, a Left Reverse Turn sign (W1-3L) shall be used.

Editorial Change Rev. 4



W1-3R
30" x 30"



W1-4R
30" x 30"

For additional protection the Advisory Speed plate (sec. 2C-35) may be used.

2C-7 Reverse Curve Sign (W1-4)

The Reverse Curve sign is intended for use to mark two curves in opposite directions, as defined in the warrants for curve signs (sec. 2C-5) that are separated by a tangent of less than 600 feet. If the first curve is to the right, a Right Reverse Curve sign (W1-4R) shall be used, and if the first curve is to the left, a Left Reverse Curve sign (W1-4L) shall be used.

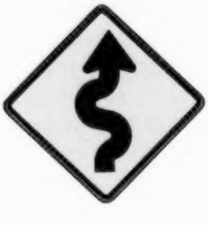
For additional protection the Advisory Speed plate (sec. 2C-35) may be used.

2C-8 Winding Road Sign (W1-5)

The Winding Road sign is intended for use where there are three or more turns or curves, as defined in the warrants for Turn and Curve signs (secs. 2C-4 and 5), separated by tangent distances of less than 600 feet. II-29(c) Rev. 2

If the Winding Road sign is used it shall be erected in advance of the first curve. Where the three or more turns or curves extend over a roadway length of 1 mile or more, the supplemental plaque (W7-3a, NEXT X MILES) may be installed below the W1-5 sign. II-29(c) Rev. 2

Additional warning may be provided by the installation of road delineation markers (sec. 3D-4) and by use of the Advisory Speed plate (sec. 2C-35). Editorial Change Rev. 4



W1-5R
30" x 30"

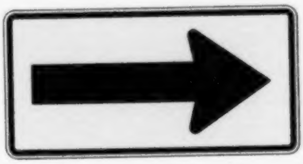
2C-9 Large Arrow Sign (W1-6, W1-7)

The Large Arrow sign shall be a horizontal rectangle with a standard size of 48 × 24 inches, having a large arrow (W1-6) or a double head arrow (W1-7). It shall have a yellow background with symbol in black.

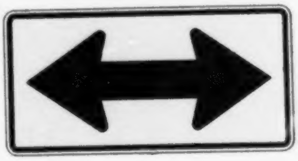
A Large Arrow sign is intended to be used to give notice of a sharp change of alignment in the direction of travel. It is not to be used where there is no change in the direction of travel (ends of medians, center piers, etc.).

The Large Arrow sign, when used, shall be erected on the outside of a curve or on the far side of an intersection, in line with, and at right angles to, approaching traffic.

To be effective the Large Arrow sign should be visible for at least 500 feet and trial runs by day and night may be desirable to determine final positioning.



W1-6
48" x 24"

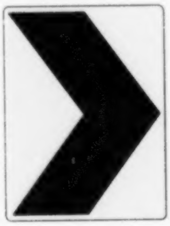


W1-7
48" x 24"

2C-10 Chevron Alignment Sign (W1-8)

The Chevron Alignment sign shall be a vertical rectangle with a minimum size of 12 inches by 18 inches. It shall have a yellow background with chevron symbol in black. The size of sign used will be determined by an engineering investigation.

A Chevron Alignment sign may be used as an alternate or supplement to standard delineators and to the Large Arrow sign. The Chevron Alignment sign is intended to be used to give notice of a sharp change of alignment with the direction of travel. Chevron Alignment sign is intended to provide additional emphasis and guidance for vehicle operators as to changes in horizontal alignment of the roadway. II-63 (c) Rev. 3



W1-8
18"×24"

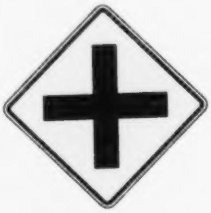
Chevron Alignment signs, when used, are erected on the outside of a curve, sharp turn, or on the far side of an intersection, in line with and at right angles to approaching traffic. Spacing of the signs should be such that the motorists always have two in view, until the change in alignment eliminates the need for the signs. To be effective, Chevron Alignment signs should be visible for at least 500 feet; trial runs by day and night may be desirable to determine final positioning.

2C-11 Cross Road Sign (W2-1)

The Cross Road sign is intended for use on a through highway to indicate the presence of an obscured crossroad intersection. It is not ordinarily used where Junction signing (secs. 2D-14, 2D-29) or advance route turn assembly signs (sec. 2D-30) are present.

The relative importance of the intersecting roads may be shown by different widths of line in the diagram.

The diagram for a crossroad intersection with a slight offset should indicate that the side roads are not opposite each other. If the crossroad occurs in the vicinity of a curve the symbol may be modified appropriately.

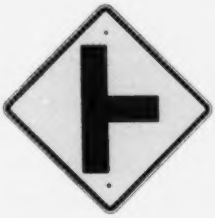


W2-1
30" x 30"

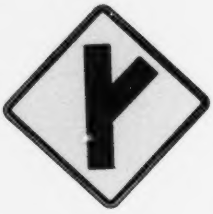
2C-12 Side Road Sign (W2-2, W2-3)

The Side Road sign, showing a side-road symbol, either left or right, and at an angle of either 90 or 45 degrees, is intended for use in advance of a side-road intersection according to the same warrants as set forth for the Cross Road sign (sec. 2C-11).

The relative importance of the intersecting roads may be shown by different widths of line in the diagram. If the side road occurs in the vicinity of a curve the symbol may be modified appropriately.



W2-2
30" x 30"



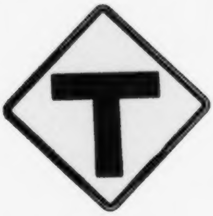
W2-3
30" x 30"

2C-13 T Symbol Sign (W2-4)

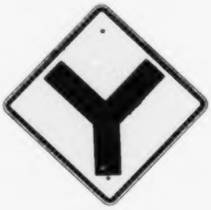
The T symbol sign is intended for use to warn traffic approaching a T-intersection on the road that forms the stem of the T, i.e., where traffic must make a turn either to the right or to the left. The sign should not generally be used on an approach where traffic is required to stop before entering the intersection, nor at a T-intersection that is channelized by traffic islands, nor where Junction signing or Advance Turn Arrows are present.

The relative importance of the intersecting roads may be shown by different widths of line in the diagram.

It may be desirable to place a double-headed Large Arrow sign at the head of the T, directly in line with approaching traffic (sec. 2C-9).



W2-4
30" x 30"



W2-5
30" x 30"

2C-14 Y Symbol Sign (W2-5)

The Y symbol sign is intended for use to warn traffic approaching a Y-intersection on the road that forms the stem of the Y. The sign should not generally be used at a Y-intersection that is channelized by traffic islands, nor where Junction signing or Advanced Turn Arrows are present.

The relative importance of the intersecting roads may be shown by different widths of line in the diagram.

It may be desirable to erect a double-headed Large Arrow sign (sec. 2C-9) at the fork of the Y directly in line with approaching traffic.

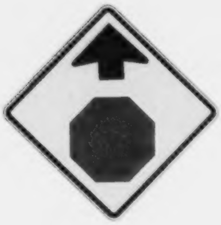
2C-15 Stop Ahead Sign (W3-1)

A STOP AHEAD sign is intended for use on an approach to a STOP sign that is not visible for a sufficient distance to permit the driver to bring his vehicle to a stop at the STOP sign. Obstruction(s) causing the limited visibility may be permanent or intermittent.

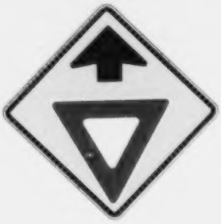
The STOP AHEAD sign shall be a minimum of 30 x 30 inches.

In some cases, it may be used for emphasis where there is poor observance of the STOP sign.

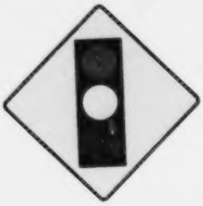
The word message STOP AHEAD sign (W3-1) may be used as an alternate to the symbol sign (W3-1a).



W3-1a
36" x 36"



W3-2a
36" x 36"



W3-3
36" x 36"

2C-16 Yield Ahead Sign (W3-2)

A YIELD AHEAD sign is intended for use on an approach to a YIELD sign that is not visible for a sufficient distance to permit the driver to bring his vehicle to a stop at the YIELD sign. Obstruction(s) causing the limited visibility may be permanent or intermittent.

The YIELD AHEAD sign shall be a minimum of 30 x 30 inches.

The word message YIELD AHEAD sign (W3-2) may be used as an alternate to the symbol sign (W3-2a).

2C-17 Signal Ahead Sign (W3-3)

A Signal Ahead sign is intended for use in advance of any signalized location where physical conditions prevent drivers from having a continuous view of at least two signal indications for distance specified in section 4B-12. The word message SIGNAL AHEAD may be used as an alternate.

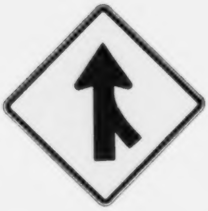
2C-18 Merge Sign (W4-1)

A Merge sign is intended for use to warn motorists that merging movements may be encountered in advance of a point where two roadways converge and no turning conflict occurs.

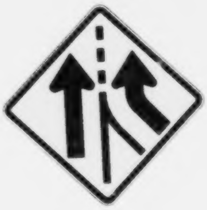
The sign should be erected on the side of the major roadway on which merging traffic will be encountered and in such a position as not to obstruct the driver's view of vehicles on the entering roadway. Ordinarily the motorists on the minor or ramp roadway are aware that they may have to merge with other traffic, but an additional sign may be placed on the entering roadway as a reminder. Where two roadways of approximately equal importance converge, a sign should be placed on each roadway.

The Merge sign should not be used where two roadways converge and merging movements are not required.

The Merge sign should not be used in place of a Pavement Width Transition sign where lines of traffic moving on a single roadway must merge due to a reduction in the actual or usable pavement width (sec. 2C-19).



W4-1
30" x 30"



W4-3
36" x 36"

2C-18.1 Added Lane Sign (W4-3)

An Added Lane sign is intended for use in advance of a point where two roadways converge and merging movements are not required. This sign should be erected in advance of the point of convergence and should be visible from both roadways; otherwise, a sign should be placed on each roadway on the side of the roadway on which the other roadway converges.

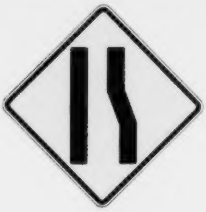
2C-19 Lane Reduction Transition Signs (W4-2) (W9-1) (W9-2)

A Lane Reduction Transition sign (W4-2) is intended for use to warn of the reduction in the number of traffic lanes in the direction of travel on a multilane highway. It is not justified in advance of the end of an acceleration lane. It may be used through maintenance or construction sites (sec. 6B-22).

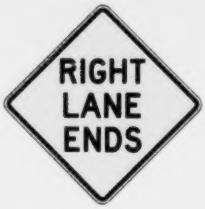
On one-way roadways where the width of the median island will permit, two such signs can be placed facing approaching traffic, one on the right side and the other on the median island.

The LANE ENDS MERGE LEFT (RIGHT) sign (W9-2) is intended for use as a supplement to the Pavement Width Transition sign (W4-2). When used, this sign shall be placed in advance of the W4-2.

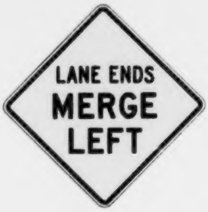
The RIGHT (LEFT) LANE ENDS sign (W9-1) is intended for use in advance of the Pavement Width Transition sign (W4-2) or the LANE ENDS MERGE LEFT (RIGHT) sign (W9-2) if it is used.



W4-2
36" x 36"



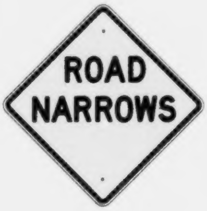
W9-1
36" x 36"



W9-2
36" x 36"

2C-20 Road Narrows Sign (W5-1)

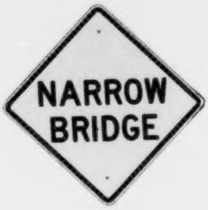
A ROAD NARROWS sign is intended for use in advance of a transition on two-lane roads where the pavement width is reduced abruptly to a width such that two cars cannot pass safely without reducing speed. Additional protection may be provided by the use of delineators and object markers.



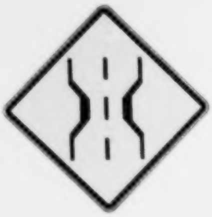
W5-1
36" x 36"

2C-21 Narrow Bridge Sign (W5-2)

A Narrow Bridge sign (W5-2, W5-2a) is intended for use in advance of a bridge or culvert having a clear two-way roadway width of 16 to 18 feet or any bridge or culvert having a roadway clearance less than the width of the approach pavement. Additional protection should be provided by the use of object markers, delineators, and pavement markings. Bridges or culverts having less than a 20-foot span and the above width also will be treated as narrow bridges and signed and delineated accordingly.



W5-2
30" x 30"



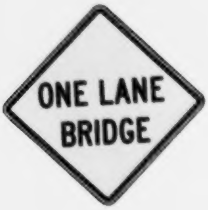
W5-2a
30" × 30"

2C-22 One Lane Bridge Sign (W5-3)

A ONE LANE BRIDGE sign is intended for use on two-way roadways in advance of bridges or culverts:

1. Having a clear roadway width of less than 16 feet
2. Having a clear roadway width of less than 18 feet when commercial vehicles constitute a high proportion of the traffic
3. When the alignment is poor on the approach to a structure having a clear roadway width of 18 feet or less.

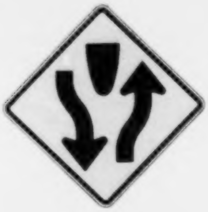
Additional protection should be provided by the use of object markers, delineators and pavement markings.



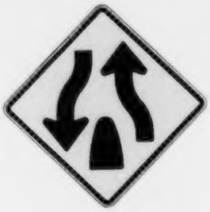
W5-3
36" x 36"

2C-23 Divided Highway (Road) Sign (W6-1)

A Divided Highway sign is intended for use on the approaches to a section of highway (not an intersection or junction) where the opposing flows of traffic are separated by a physical barrier. The word message DIVIDED HIGHWAY (ROAD) may be used as an alternate.



W6-1
36" x 36"



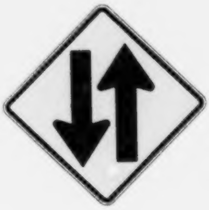
W6-2
36" x 36"

2C-24 Divided Highway (Road) Ends Sign (W6-2)

A Divided Highway (Road) Ends sign is intended for use at the end of a section of physically divided highway (not an intersection or junction) as a warning of two-way traffic ahead. The Two-Way Traffic sign (sec. 2C-25) can be used to give additional warning and notice just in advance of the transition to the two-way section. The word message DIVIDED HIGHWAY (ROAD) ENDS may be used as an alternate.

2C-25 Two-Way Traffic Sign (W6-3)

A Two-Way Traffic sign is intended for use to give warning of a transition from a separated one-way roadway to a two-way roadway. This sign may be used as required at intervals to periodically remind drivers that they are on a two-way roadway. The word message TWO WAY TRAFFIC may be used as an alternate legend.

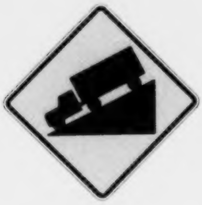


W6-3
30" x 30"

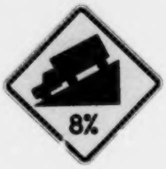
2C-26 Hill Sign (W7-1 to 4)

The Hill sign (W7-1) is intended for use in advance of a downgrade where the length, percent of grade, horizontal curvature, or other physical features require special precautions on the part of drivers. When the percent grade is shown within the Hill sign (W7-1b) the message X% shall be placed below the inclined ramp/truck symbol. The word message HILL (W7-1a) may be used as an alternate legend.

II-54 (c)
Rev. 3
Editorial
Change
Rev. 4



W7-1
30" x 30"



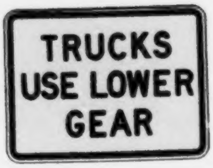
W7-1b
30"×30"

The Hill (W7-1) and Grade (W7-3) signs should be used in advance of downgrades for the following conditions:

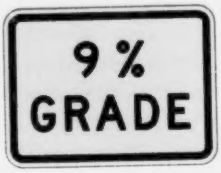
5% grade and more than 3,000 feet long
6% grade and more than 2,000 feet long
7% grade and more than 1,000 feet long
8% grade and more than 750 feet long
9% grade and more than 500 feet long

These signs should also be installed for steeper grades or where accident experience and field observations indicate a need.

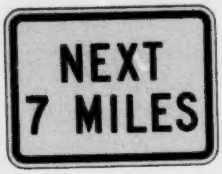
The supplemental plaques (W7-2 series, W7-3 series) or other appropriate legends and larger signs should be used for emphasis or where special hill characteristics exist. On longer grades, the use of the mileage plaque (W7-3a or W7-3b) at periodic intervals of approximately 1 mile spacing should be considered.



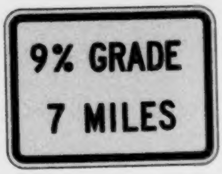
W7-2b
24"×18"



W7-3
24"×18"

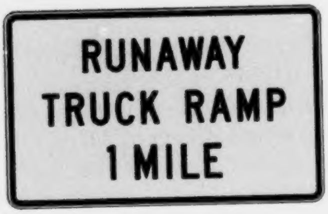


W7-3a
24"×18"

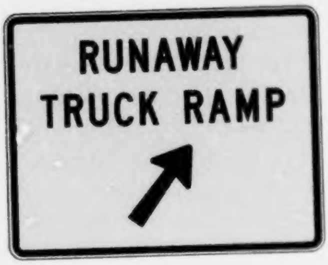


W7-3b
24"×18"

Runaway truck ramps are desirable for the safe deceleration and stopping of runaway vehicles on long, steep downgrades where installation is practical. When such ramps are installed, the associated signing (W7-4, W7-4a) shall be black on yellow with the message "Runaway Truck Ramp." A supplemental panel may be used with the words "Sand," "Gravel," or "Paved" to describe the ramp surface. These advance warning signs should be located in advance of the gore approximately one mile, one-half mile, and then one at the gore. A regulatory sign near the entrance should be used containing the message "Runaway Vehicles Only" to discourage other motorists from entering the ramp. No Parking signs may be placed as required near the ramp entrance.



W7-4
78"×48"



W7-4a
78"×60"

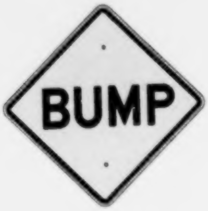
Some hills have potentially hazardous conditions such as a stop condition, railroad grade crossing, sharp curvature or a community that may not be readily apparent to an unfamilar driver. A truck turnout at the hill crest and a special trucker information diagrammatic sign may be necessary for these situations.

2C-27 Bump and Dip Signs (W8-1, W8-2)

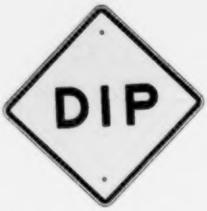
These signs are intended for use to give warning of a sharp rise or depression in the profile of the road that is sufficiently abrupt to create a hazardous condition to cause considerable discomfort to passengers, to cause a shifting of the cargo, or to deflect a vehicle from its true course at the normal driving speeds for the road.

It may be desirable at some locations to supplement these signs with an Advisory Speed plate (sec. 2C-35).

The DIP sign shall not be used at a short stretch of depressed alignment that may momentarily hide a vehicle. Such a condition should be treated as a no-passing zone (secs. 3B-3 to 5).



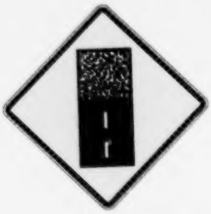
W8-1
30" x 30"



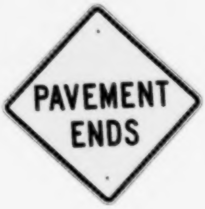
W8-2
30" x 30"

2C-28 Pavement Ends Sign (W8-3)

A Pavement Ends sign is intended for use to warn where a pavement surface changes from a hard-surfaced pavement to a low-type surface or earth road. The word message PAVEMENT ENDS may be used as an alternate.



W8-3a
36"×36"

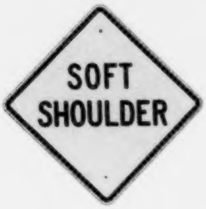


W8-3
30" x 30"

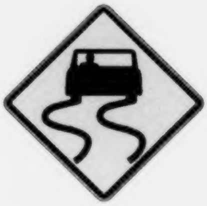
2C-29 Soft Shoulder Sign (W8-4)

The SOFT SHOULDER sign is intended for use to warn of a shoulder condition that presents a hazard to vehicles that may get off the pavement.

One sign shall be placed near the beginning of the soft-shoulder condition, and other signs shall be placed at intervals throughout the length of the road where the condition exists.



W8–4
30" x 30"



W8–5
30" x 30"

2C-30 Slippery When Wet Sign (W8-5)

The Slippery When Wet sign is intended for use to warn of a condition where the highway surface is extraordinarily slippery when wet.

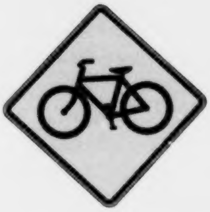
It should be located in advance of the beginning of the slippery section and at appropriate intervals on long sections of such pavement.

2C-31 Advance Crossing Signs (W11 Series)

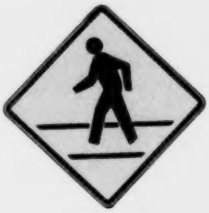
Advance Crossing signs should be used to alert vehicle operators to unexpected entries into the roadway by pedestrians, trucks, bicyclists, animals, and other potential conflicts. These crossings may be relatively confined, or may occur randomly over a substantial distance of roadway.

Where such crossings are confined to a single location, the Advance Crossing sign may be supplemented with an auxiliary distance sign specifying the distance to the crossing, or the crossing point may be identified by a Crossing sign (sec. 2C-32). Where such crossings occur randomly, an auxiliary distance sign specifying the length of highway section upon which the potential hazard exists may be used. If the section of roadway where the potential hazard exists is quite long, additional signs may be located at intervals, with appropriate adjustments in such legends.

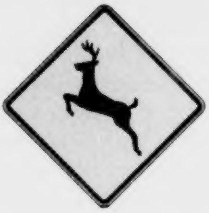
If an unexpected hazard is seasonal or temporary, Advance Crossing signs shall be removed or covered when the hazardous condition terminates.



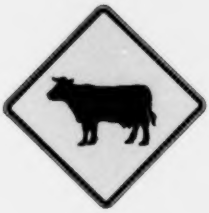
W11-1
30" x 30"



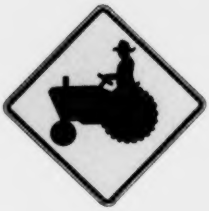
W11A-2
30"×30"



W11-3
30" x 30"



W11-4
30" x 30"



W11-5
30" x 30"

2C-32 Crossing Signs (W11A Series)

Crossing signs may be used to supplement Advance Crossing signs as a means of assisting the vehicle operator in defining the specific point of crossing. Such signs should be used only at locations that are unusually hazardous or at locations not readily apparent. When used, the Crossing sign should be located immediately adjacent to the crossing location. Crossing signs are normally limited to nonmotorized crossings, such as pedestrians, bicyclists, and cattle. These signs are distinguished from Advance Crossing signs (W11 Series) by the addition of crossing lines on the symbol plate.

If an unexpected hazard is seasonal or temporary, Crossing signs shall be removed or covered when the hazardous condition terminates.

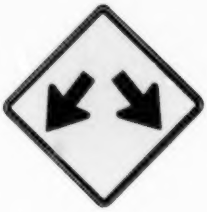
In many instances it may be desirable to define the crossing by pavement markings (sec. 3B-15).

2C-33 Double Arrow Sign (W12-1)

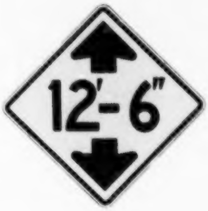
The Double Arrow sign showing two arrows pointing downward to right and left is intended for use at loading and refuge islands, traffic islands with curbs, and other obstructions in the roadway, where traffic is permitted to pass on either side of the island or obstruction. Traffic separated by this sign may either rejoin the through roadway or change directions to another destination. It shall have a standard, and minimum, size of 24 × 24 inches.

The sign should normally be mounted at a height of 7 feet from the pavement to the bottom of the sign. On an island, it should be mounted at the approach end or as close thereto as practicable. It should be mounted on the face of, or just in front of a pier or other large obstruction, in which case stripe markings on the obstruction (sec. 3C-2) should be discontinued to leave a 3-inch space around the outside of the sign.

Where all traffic must keep to the right of the island or other obstruction, the Keep Right regulatory sign (sec. 2B-25) should be used.



W12-1
24" x 24"



W12-2
36" x 36"

2C-34 Low Clearance Sign (W12-2)

The Low Clearance sign is intended for use to warn vehicle operators of clearances less than the maximum vehicle height permitted plus 12 inches. It may be erected on or in advance of the structure. If a sign is placed on the structure, it may be a rectangular shape with the legend (12) FT (6) IN.

The actual clearance is normally shown on the sign to the nearest inch not exceeding the actual clearance. However, in areas that experience changes in temperature causing frost action, an allowance, not exceeding 3 inches, for this condition, is recommended.

Where the clearance is less than the legal limit, a sign to that effect should be placed at the nearest intersecting road or wide point in the road at which a vehicle can detour or turn around.

In the case of an arch or other structure under which the clearance varies greatly, two or more signs should be used as necessary on the structure itself, to give information as to the clearance over the entire roadway.

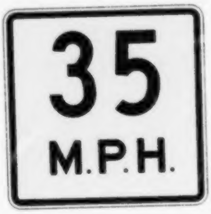
Clearances should be checked periodically, particularly in areas where resurfacing operations have taken place.

2C-35 Advisory Speed Plate (W13-1)

The advisory speed plate is intended for use to supplement warning signs. The standard size of the Advisory Speed plate shall be 18 × 18 inches. Advisory Speed plates used with 36-inch and larger warning signs shall be 24 × 24 inches.

The plate shall carry the message (35) MPH in black on a yellow background except for construction and maintenance signs (sec. 6B-34). The speed shown shall be a multiple of 5 miles per hour. The plate may be used in conjunction with any standard yellow warning sign to indicate the maximum recommended speed around a curve or through a hazardous location. It shall not be used in conjunction with any sign other than a warning sign, nor shall it be used alone. When used, it shall be mounted on the same assembly and normally below the standard warning sign (fig. 2-1, page 2A-9).

Except in emergencies, or at construction or maintenance sites, where the situation calling for an advisory speed is temporary, an Advisory Speed plate shall not be erected until the recommended speed has been determined by accepted traffic engineering procedures. Because changes in surface characteristics, sight distance, etc., may alter the recommended speed, each location should be periodically checked and the speed plate corrected if necessary.

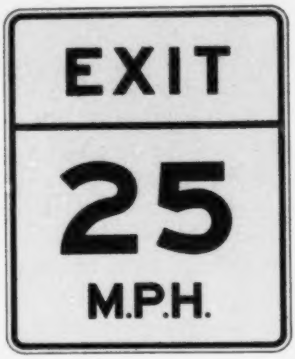


W13-1
18" x 18"
24" x 24"

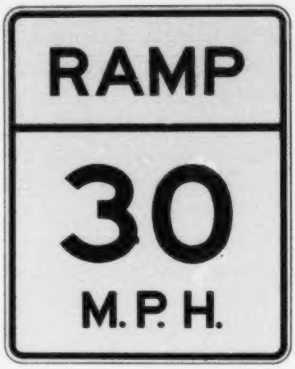
2C-36 Advisory Exit Speed Signs (W13-2, W13-3)

The Exit Speed or Ramp Speed signs are intended for use where engineering investigations of roadway, geometric, or operating conditions show the necessity of advising drivers of the maximum recommended speed on a ramp.

The sign should be posted along the deceleration lane or along the ramp so that it is visible in time for the driver to make a safe slowing and exiting maneuver. Where additional advisory speed indication is needed on the ramp well beyond the gore, a standard warning sign with an Advisory Speed plate (W13-1) is to be used.



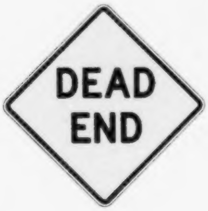
W13–2
48" x 60"



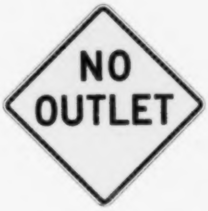
W13–3
48" x 60"

2C-37 Dead End Signs (W14-1, W14-2)

The DEAD END sign (W14-1) and NO OUTLET sign (W14-2) are intended for use to warn of a street or road which has no outlet and which terminates in a dead end or cul-de-sac. The sign shall be posted a sufficient advance distance to permit the vehicle operator to avoid the dead end by turning off, if possible, at the nearest intersecting street.



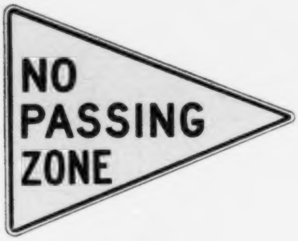
W14–1
30" x 30"



W14–2
30" x 30"

2C-38 No Passing Zone Sign (W14-3)

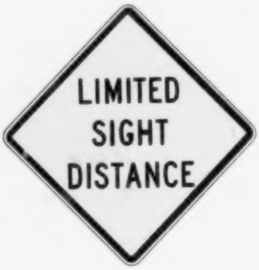
Because of the demonstrated target value given by this sign in critical passing maneuvers, the NO PASSING ZONE sign should be used on two-lane roads to warn of the beginning of no-passing zones identified by either conventional pavement markings or DO NOT PASS signs or both. When used, it shall be erected on the left side of the roadway at the beginning of the no-passing zones.



W14–3
36" x 48" x 48"

2C-39 Limited Sight Distance Sign (W14-4)

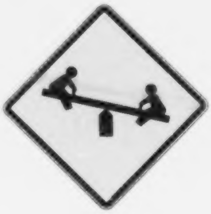
The LIMITED SIGHT DISTANCE sign, with supplemental Advisory Speed plate (W13-1), is designed for use on vertical curves which do not have adequate safe stopping sight distance available. This type signing is not to be a substitute for sound engineering judgment (based on safety considerations or known problem locations) that would warrant improving the sight distance by an engineering solution.



W14–4
30" × 30"

2C-40 Playground Sign (W15-1)

The W15-1 Playground Sign may be used only in advance of a designated children's play area to warn of the potential high concentration of young children in that area. This sign is not intended to regulate the speed of vehicles but to warn motorists of a potential hazardous condition that may call for a reduction in speed.



W15-1
36″×36″

2C-41 Other Warning Signs

Warning signs other than those specified above may be required under special conditions. Such signs should conform with the general specifications for shape, color, and placement of warning signs (sec. 2C-1 to 2C-3).

Special warning signs for highway construction and maintenance operations, school areas, railroad grade crossings, and bicycle facilities can be found in Parts VI through IX of this Manual.

D. GUIDE SIGNS—CONVENTIONAL ROADS

2D-1 Scope of Conventional Road Guide Sign Standards

Standards for Conventional Road Guide Signs prescribed herein shall apply to any road or street other than an expressway or freeway.

2D-2 Application

Guide signs are essential to guide vehicle operators along streets and highways, to inform them of intersecting routes, to direct them to cities, towns, villages, or other important destinations, to identify nearby rivers and streams, parks, forests, and historical sites, and generally to give such information as will help them along their way in the most simple, direct manner possible.

2D-3 Color, Reflectorization, and Illumination

Except where otherwise specified herein for individual signs or groups of signs or markers, guide signs on conventional roads and streets shall have a white message on a green background.

Requirements for reflectorization or illumination are stated under the specific headings for individual guide signs or groups of signs. General provisions are given in sections 2A-16 through 2A-18.

2D-4 Size of Signs

For most guide signs the legend is so variable that there can be no rigidly standardized size. The sign size must be fixed primarily in terms of length of the message and the size of the lettering and spacing necessary for proper legibility. However, for signs with standardized designs, such as route markers, it is practicable to fix standard sizes and these are given in the Standard Highway Signs Booklet.*

Under some circumstances, particularly for overhead signs, the available space may limit sign width. A sign mounted over a particular roadway lane to which it applies may have to be limited in width to the lane width. Where vertical clearances are limited, and standard sign design cannot be used, a reduced letter height, interline and edge spacing may be used. When a reduction in the standard size is necessary, the design used should be as nearly comparable to standards as possible.

2D-5 Lettering Style

The standard lettering for conventional highway signs is uppercase letters (sec. 2A-15). However, when letter height exceeds 8 inches, place names on guide signs should be composed of lower-case letters with an initial upper-case letter. The initial upper-case letters shall be approximately 1⅓ times the "loop" height of the lower-case letters. Designs have been developed for the upper-case and lower-case alphabets, together with tables of spacing. These are provided in the Standard Alphabets for Highway Signs and Pavement Markings.*

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*Available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590

2D-6 Size of Lettering

For guide signs with varying legend, sign legibility is a direct function of letter size. The legibility distance must give the driver sufficient time to read the sign before passing. Although under the best conditions a guide-sign message can be read and understood in a brief glance, a reasonable safety factor must be allowed for inattention, blocking of view by other vehicles, unfavorable weather, inferior eyesight, or other causes for delayed or slow reading. On the other hand, the usual repetition of guide information on successive signs where conditions permit often gives a driver more than one opportunity to obtain the information needed.

Though the reading time for any given sign varies greatly with the approach speed, standard lettering sizes should be consistent on any particular class of highways. The same conditions that induce lower speed—heavy traffic, frequent intersections or interchanges, unfavorable alignment, or extraneous distractions—usually create a need for greater legibility. Hence the size standards set forth are related to the type of highway rather than to variable speeds on any class of highways (table II-1, page 2E-4).

The minimum sizes specified should be exceeded where conditions indicate a need for greater legibility.

In rural districts on major routes, the principal legend on guide signs shall be in letters at least 6 inches in height. On less important rural roads and on urban streets the principal legend shall be in letters at least 4 inches high. Sign panels shall be large enough to accommodate the required legend without crowding.

Recommended layouts have been developed for standard highway signs showing interline, edge spacing and other specification detail.**

2D-7 Amount of Legend

Regardless of letter size, the legend on a guide sign must be kept to a minimum to be legible at a glance during the few moments that a driver can turn his eyes from the road. Guide signs should be limited to three lines of principal legend. Where two or more signs are included in the same overhead display, extra effort should be made to further reduce and simplify the amount of legend.

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* Ibid.

**Ibid.

"Principal legend" here includes only place names, route numbers, and street names. Symbols, action information, cardinal directions and exit numbers may make up other lines of legend, within reasonable limits.

2D-8 Arrows and Symbols

Arrows are used on many guide signs to indicate the directions toward designated routes or destinations. Arrows are pointed at any desired angle to convey a clear comprehension of the direction to be taken. At right-angle intersections a horizontal arrow is appropriate. On a roadside sign a directional arrow for a straight-through movement should point upward. For a turn the arrow should be pointed upward as will best describe the design of the intersection, and at an angle related to the sharpness of the turn.

On overhead signs where it is desired to indicate a lane to be followed, the arrow shall point downward toward the center of that lane. Where a roadway is leaving the through lanes, the arrows shall point upward at an angle representative of the alignment of the exit roadway. If required, the through roadway lanes will be identified by downward pointing arrows.

Downward pointing arrows shall be used only on overhead guide signs which restrict the use of specific lanes to traffic bound for the destination(s) and/or route(s) indicated by these arrows. Downward pointing arrows shall not be used unless an arrow can be pointed to each lane that can be used to reach the destination shown on the sign.

Arrows may be placed below the other sign legend, or to one side of it. At an exit, an arrow should be placed at the side of the sign which will reinforce the movement of the exiting traffic.

Figure 2-6 (page 2D-4) shows the two standard arrows approved for use on guide signs. The "UP" arrow is also intended to be used for horizontal and slanted applications. Detailed dimensions of the arrows are shown in the Appendix of the Standard Highway Signs Booklet.* For adequate legibility, it is recommended that the width across the barbs of the arrow be at least equal to the height of the largest letters on the sign; and for short downward pointing arrows on overhead signs, about 1¾ times the letter height.

Diagrammatic signing used on conventional roads should follow the principles set forth in section 2F-24.

2D-9 Numbered Highway Systems

The purpose of numbering and marking highway systems is to identify routes and facilitate travel over the shortest and best roads.

The Interstate System and the United States (U.S.) System are numbered by the American Association of State Highway and Transporta-

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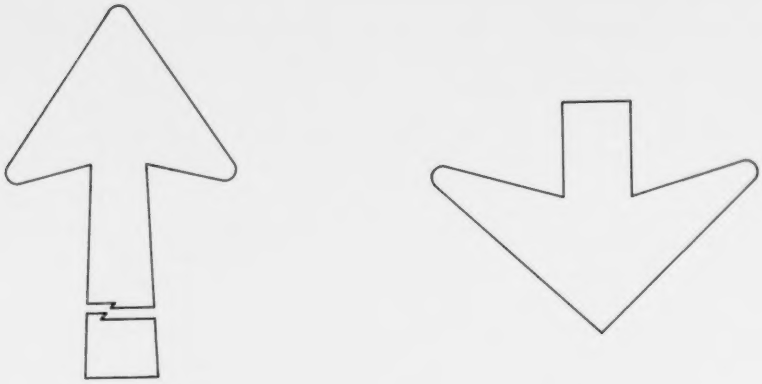
*Available from Federal Highway Administration (HTO-20), Washington, D.C. 20590



"UP" ARROW "DOWN" ARROW

Figure 2-6. Standard arrows for use on guide signs.

tion Officials, upon recommendation of the State highway organizations. State and county systems are numbered by the appropriate authorities.

The basic guide for designating and numbering the U.S. System is the "Purpose and Policy in the Establishment and Development of United States Numbered Highways," published by the American Association of State Highway and Transportation Officials.*

The principles of this policy should be followed in establishing other systems, with effective coordination between adjacent jurisdictions. Care should be taken to avoid the use of numbers or other designations which have been assigned to Interstate, U.S. or State routes in the same area. Overlapping numbered routes should be avoided, and the systems shall be given preference, in this order: Interstate, United States, State and County.

2D-10 Route Markers and Auxiliary Markers

Route markers shall be used to identify and mark all numbered highways. The markers for each system of numbered highways, which are distinctive in shape and color, shall be used only on that respective system and the approaches thereto.

To accomplish their purpose route markers are usually mounted in assemblies which are formed when the route markers are accompanied by any of the various types of auxiliary markers.

Route markers as well as any auxiliary markers which accompany them shall be reflectorized for nighttime visibility as detailed in subsequent sections.

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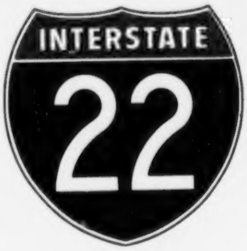
*Available from the American Association of State Highway and Transportation Officials, 444 North Capitol Street, N.W., Suite 225, Washington, D.C. 20001.

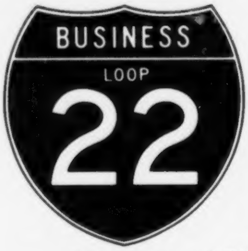
2D-11 Design of Route Markers (M1-1 to 7)

The design of standard route markers is detailed in the Standard Highway Signs Booklet.* Other route marker designs shall be established by the authority having jurisdiction. Additional design and use requirements are as follows:

1. Interstate Route Markers for use on intersecting highways and roads approaching an interchange with an Interstate route shall consist of a cutout shield, with the route number in white letters on a blue background, the word INTERSTATE in white letters on a red background, and white border and may contain the State name in white letters on a blue background. A 24 × 24 inches size is prescribed to accommodate route numbers with one or two digits, and a 30 × 24 inches size for route numbers having three digits (see also sec. 2F-40).



**Interstate
Route Marker
M1-1
24" x 24" (2-digit)
30" x 24" (3-digit)**



**Off-Interstate
Business Marker
M1-2
M1-3
24" x 24" (2-digit)
30" x 24" (3-digit)**

2. Off-Interstate Business Route Markers shall consist of a cutout shield carrying the number of the connecting Interstate route and the words BUSINESS (LOOP or SPUR). The legend and border shall be white on a green background, and the shield shall be of the same shape and dimensions as the Interstate Route Marker previously described. In no instance is the word INTERSTATE to appear on the Off-Interstate Business Route Marker. For improved contrast a white square panel may be placed between the green guide sign and the Off-Interstate Business Route Marker. This marker may be used on a major highway that is not a part of the Interstate System, but one that serves the business area of a city from interchanges on the System.

3. U.S. Route Markers shall consist of a rectangular 24 × 24 inch or 30 × 24 inch plate, with black numerals on a white shield surrounded by a black background, without a border. This marker shall be used on all

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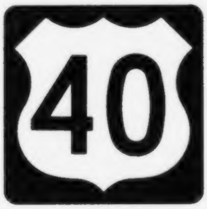
*Available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590

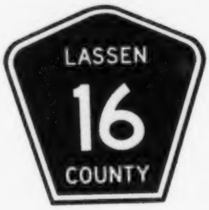
U.S. routes and in connection with route marker assemblies on intersecting highways.

4. State Route Markers are to be designed by the individual State highway departments. However, the States are encouraged to adopt a uniform State Route Marker. This Marker should be a square plate of approximately the same size as the U.S. Route Marker, and containing comparable the same size black numerals on a white area surrounded by a black background without a border. The shape of the white area is to be circular in the absence of any determination to the contrary by the individual states concerned.

5. Wherever County road authorities elect to establish and identify a special system of important County roads, County road identification markers are to be designed and used as specified in the publication "A Proposal for a Uniform County Route Marker Program on a National Scale."* The Uniform County Route Marker shall be a pentagonal shape and shall consist of a reflectorized yellow legend (County name, route letter and number) and border on a reflectorized blue background. County Route Markers displaying two digits or the equivalent (letter and numeral or two letters) shall have a minimum size 18 × 18 inches; those carrying three digits or the equivalent shall have a minimum size of 24 × 24 inches. When used with other route markers in common assemblies the County Route Marker should be of a size compatible with that of the other route markers. For improved contrast a yellow square panel may be placed between the green guide sign and the County Route Marker.



U.S.
Route Marker
M1-4
24" x 24" (2-digit)
30" x 24" (3-digit)



County
Route Marker
M1-5
24" x 24"

6. Route markers for park and forest roads are to be designed with adequate distinctiveness and legibility and of a size compatible with other route markers used in common assemblies.

Route markers may be proportionally enlarged to any required size where greater legibility is needed. Where U.S. or State Route Markers

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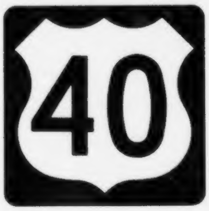
* Available from the National Association of Counties, Washington, D.C. 20006.

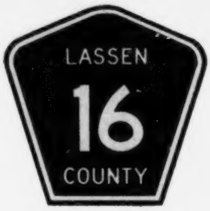
U.S. routes and in connection with route marker assemblies on intersecting highways.

4. State Route Markers are to be designed by the individual State highway departments. However, the States are encouraged to adopt a uniform State Route Marker. This Marker should be a square plate of approximately the same size as the U.S. Route Marker, and containing comparable the same size black numerals on a white area surrounded by a black background without a border. The shape of the white area is to be circular in the absence of any determination to the contrary by the individual states concerned.

5. Wherever County road authorities elect to establish and identify a special system of important County roads, County road identification markers are to be designed and used as specified in the publication "A Proposal for a Uniform County Route Marker Program on a National Scale."* The Uniform County Route Marker shall be a pentagonal shape and shall consist of a reflectorized yellow legend (County name, route letter and number) and border on a reflectorized blue background. County Route Markers displaying two digits or the equivalent (letter and numeral or two letters) shall have a minimum size 18 × 18 inches; those carrying three digits or the equivalent shall have a minimum size of 24 × 24 inches. When used with other route markers in common assemblies the County Route Marker should be of a size compatible with that of the other route markers. For improved contrast a yellow square panel may be placed between the green guide sign and the County Route Marker.



U.S.
Route Marker
M1–4
24" x 24" (2-digit)
30" x 24" (3-digit)



County
Route Marker
M1-6
24" x 24"

6. Route markers for park and forest roads are to be designed with adequate distinctiveness and legibility and of a size compatible with other route markers used in common assemblies.

Route markers may be proportionally enlarged to any required size where greater legibility is needed. Where U.S. or State Route Markers

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* Available from the National Association of Counties, Washington, D.C. 20006.

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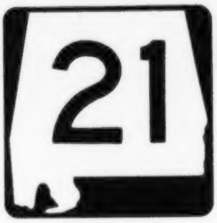
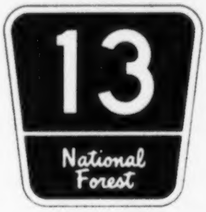


State Route Marker
M1-5
24" x 24" (2-digit) or 30" x 24" (3-digit)



Forest Route Marker
M1-7
24" x 24"

are used as components of guide signs, only the outline of the shield or other distinctive shape should be used as shown in the illustration of the Combination Junction sign (sec. 2D-14).

Route markers shall be fully reflectorized as color design permits.

2D-12 Design of Route Marker Auxiliaries

Route marker auxiliaries carrying word legends, except the JCT marker, should have a standard size of 24 × 12 inches. Those carrying arrow symbols, or the JCT marker, should have a standard size of 21 × 15 inches. Auxiliary markers carrying word messages and mounted with 30 × 24 inch Interstate Route Markers should be 30 × 15 inches. With route markers of larger sizes, the auxiliary markers should be suitably enlarged, but should not exceed the width of the route marker itself.

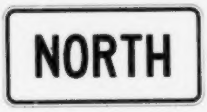
All route marker auxiliaries shall match the color combination of the respective marker which they supplement.

Detour markers have a distinctive design as described in section 2D-24.

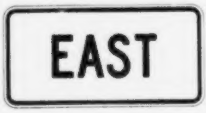
If desired, a route marker and any auxiliaries used with it may be combined on a single panel of approximately the same overall dimensions as the assembly.

2D-13 Junction Marker (M2-1)

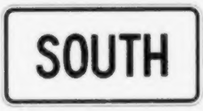
The Junction marker shall carry the abbreviated legend JCT and is to be mounted at the top of an assembly (sec. 2D-29), either directly above the route marker or above a marker for an alternative route (sec. 2D-17) which is part of the route designation. The minimum size of the Junction marker shall be 21 × 15 inches for compatibility with auxiliary markers carrying arrow symbols.



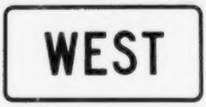
M3–1
24" x 12"



M3–2
24" x 12"



M3–3
24" x 12"

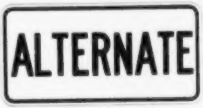


M3–4
24" x 12"

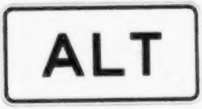
be mounted directly above a route marker for use on a route designated as an alternate to a route of the same number between two points on that route.

2D-17 Alternate Marker (M4-1, M4-1a)

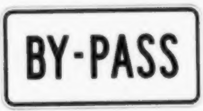
The ALTERNATE (or ALT) marker is to be used to indicate an officially designated alternate routing of a numbered route between two points on that route. The shorter or better constructed route should be given the regular number.



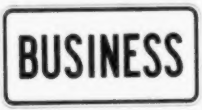
M4–1
24" x 12"



M4–1a
24" x 12"



M4–2
24" x 12"



M4–3
24" x 12"

2D-18 Bypass Marker (M4-2)

The BYPASS marker is to be used to designate a route that branches from the regular numbered route through a city, bypasses a part of the city or congested area, and rejoins the regular numbered route beyond the city.

2D-19 Business Route Marker (M4-3)

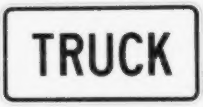
The BUSINESS route marker is to be used to designate an alternate route that branches from a regular numbered route, passes through the business portion of a city and rejoins the regularly numbered route beyond that area.

2D-20 Truck Route Marker (M4-4)

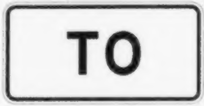
The TRUCK marker is to be used to designate an alternate route that branches from a regular numbered route, bypasses an area which is congested or where height or weight limitations have been established, and rejoins the regularly numbered route beyond that area.

2D-21 To Marker (M4-5)

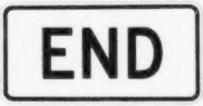
The TO marker is to be used to provide directional guidance to a particular road facility (sec. 2D-33) from other highways in the vicinity and is to be mounted directly above a route marker.



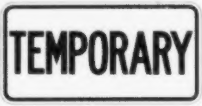
M4-4
24" x 12"



M4-5
24" x 12"



M4-6
24" x 12"



M4-7
24" x 12"

2D-22 End Marker (M4-6)

The END marker is for use where the route being traveled ends at a junction with another route. This marker is to be mounted either directly above a route marker, or above a marker for an alternative route (sec. 2D-16) which is part of the designation of the route being terminated.

2D-23 Temporary Marker (M4-7)

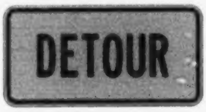
The TEMPORARY marker is to be used to mark for an interim period a section of highway connecting completed portions of a route that is not planned as a permanent part of a regular numbered route. This marker is to be mounted either directly above the route marker or above a Cardinal Direction marker or a marker for an alternative route which is part of the route designation.

Temporary markers shall be promptly removed when the temporary route is abandoned.

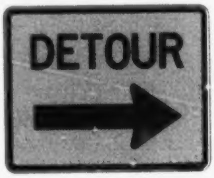
2D-24 Detour Marker (M4-8)

The DETOUR marker is to be used to mark a temporary route that branches from a regular numbered route, bypasses a section of a route which is closed or blocked by construction, major maintenance, roadway damage or traffic emergency and rejoins the regularly numbered route beyond that section.

The DETOUR marker shall have a black legend on a reflectorized orange background. It is to be mounted at the top of a route marker assembly. (See section 6B-38.)



M4-8
24" x 12"



M4-9R
30" x 24"

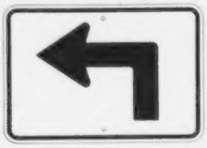
2D-25 Detour Sign (M4-9R and 9L)

An alternative method for marking detours, particularly in emergencies, is the use of the DETOUR sign (M4-9). This is a rectangular sign having a black message and border on a reflectorized orange background.

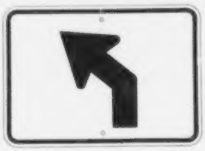
This sign is to be used where a route number does not exist; or where, over relatively short distances, it is not necessary to show route numbers to guide traffic along the detour and back to its desired route. It is for use in emergency situations and for periods of short duration. The Detour Arrow sign (sec. 6B-38) is prescribed for use on barricades in the roadway where a road is closed for construction or for major maintenance operations.

2D-26 Advance Turn Arrow (M5-1, M5-2)

The Advance Turn Arrow marker displays a right or left arrow, the shaft of which is bent at a right angle or at a 45° angle. It is to be mounted below the route marker in advance turn assemblies.



M5-1
21" x 15"



M5-2
21" x 15"

2D-27 Directional Arrow (M6-1 to M6-7)

The Directional Arrow marker displays a single- or double-headed arrow pointing in the general direction that a route may be followed. It is to be mounted below the route marker in directional assemblies.

2D-28 Route Marker Assemblies

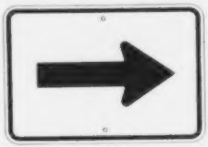
A Route Marker assembly consists of a route marker and auxiliary markers which further identify the route and indicate direction. Assemblies for two or more routes, or for different directions on the same route, are mounted in groups on a common support.

Route Marker assemblies shall be erected on all approaches to the intersection of numbered routes, and may be erected on the approaches to numbered routes on unnumbered roads and streets which carry an appreciable amount of traffic destined for the numbered route.

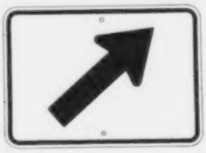
Where two or more routes follow the same section of highway, the Route Markers for Interstate, U.S., or State and County routes shall be mounted in that order from the left in horizontal arrangements and from the top in vertical arrangements. Subject to this order of precedence, Route Markers for lower-numbered routes shall be placed at the left or top.

Within groups of assemblies, information for routes intersecting from the left shall be mounted at the left in horizontal arrangements and at the center of vertical arrangements. Similarly, information for routes intersecting from the right shall be at the right or bottom, and for straight-through routes at the center or top.

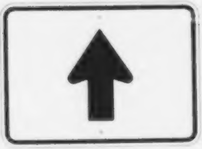
Route Marker assemblies shall be mounted in accordance with the general specifications for highway signs, with the lowest unit in the assembly at the height prescribed for single signs.



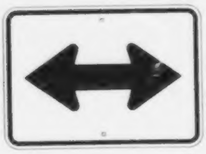
M6–1
21" x 15"



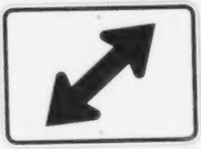
M6–2
21" x 15"



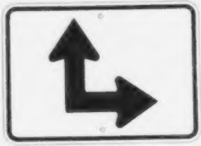
M6–3
21" x 15"



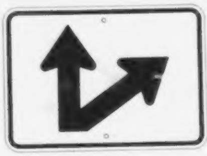
M6–4
21" x 15"



M6–5
21" x 15"



M6–6
21" x 15"



M6–7
21" x 15"

The design and location of route marker assemblies as indicated, is made mandatory by the word "shall" in the descriptive paragraphs. However, it should be recognized that groups of assemblies which include overlapping routes and multiple turns may be confusing. Where studies indicate this possibility exists, omission or combination of either route markers or auxiliary markers is permitted, provided that clear directions are given to motorists.

2D-29 Junction Assembly

A Junction assembly shall consist of a Junction marker and a Route Marker.

The Junction assembly shall be erected in advance of every intersection where a marked route is intersected or joined by another marked route. The Route Marker shall carry the number of the intersected or joined route. Where two or more routes are to be indicated, one Junction marker can be used for the assembly and all Route Markers grouped in a single mounting, or a Combination Junction sign (sec. 2D-14) may be used.

In urban districts, the Junction assembly shall be erected approximately midway in the block preceding the intersection, but generally not more than 300 feet in advance of the intersection.

In rural districts, the Junction assembly shall be erected not less than 400 feet in advance of the intersection, on the right-hand side of the road. In such areas, the minimum distance between the Destination sign, the Route Turn assembly, and the Junction assembly shall be 200 feet. Where prevailing speeds are above 45 m.p.h., greater spacings are desirable.

2D-30 Advance Route Turn Assembly

An Advance Route Turn assembly shall consist of a Route Marker, an Advance Turn Arrow or word message marker, and a Cardinal Direction marker if needed.

The Advance Route Turn assembly shall be erected in advance of an intersection where a turn must be made to remain on the indicated route.

The Advance Route Turn assembly may be used as necessary to supplement the required Junction assembly in advance of intersecting routes. Where a multiple lane highway approaches an interchange or intersection with a numbered route, the Advance Route Turn assembly should be used as necessary to pre-position turning vehicles in the correct lanes from which to make their turn.

In rural districts, the Route Turn assembly should be erected not less than 400 feet in advance of the turn. In urban areas, the Route Turn assembly should be erected 300 feet in advance of the turn.

An assembly which includes an Advance Turn Arrow should never be placed where there is an intersection between it and the designated turn. Sufficient distance should be allowed between the assembly and any preceding intersection that could be mistaken for the indicated turn.

2D-31 Directional Assembly

A Directional assembly shall consist of a Route Marker, a Directional Arrow, and a Cardinal Direction marker if needed.

The various uses of Directional assemblies are outlined below:

1. Straight-through movements should be indicated by a Directional assembly with a Route Marker displaying the number of the continuing route, and a vertical arrow. A Directional assembly should not be used for a straight-through movement in the absence of other assemblies indicating right or left turns, as the Confirming marker beyond the intersection normally provides adequate guidance.
2. Turn movements (indicated in advance by a Route Turn assembly) shall be marked by a Directional assembly with a Route Marker displaying the number of the turning route and a single-headed arrow pointed in the direction of the turn.
3. The beginning of a route (indicated in advance by a Junction assembly) shall be marked by a Directional assembly with a Route Marker displaying the number of that route and a single-headed arrow pointed in the direction of the turn.
4. The end of a route shall be marked by a Directional assembly with an END marker and a Route Marker displaying the number of that route.
5. An intersected route (indicated in advance by a Junction assembly) shall be marked by:
    - (a) Two Directional assemblies, each with a Route Marker displaying the number of the intersected route, Cardinal Direction markers and single-headed arrows pointed in the directions of movement on that route, or
    - (b) A Directional assembly with a Route Marker displaying the number of the intersected route and a double-headed arrow, pointing at appropriate angles to the left, right or ahead.

It is more important that guide signs be readable at the right time and place than to be located with absolute uniformity. The following indicates the preferred locations for directional assemblies:

a. Directional assemblies should be located on the near right-hand corner of the intersection.

b. At major intersections and at Y or offset intersections it is often desirable to install additional assemblies on the far right-hand or left-hand corner to confirm the near-side assemblies.

c. When the near-corner position is not practical for Directional assemblies, the far right-hand corner is the preferred alternative, with oversize signs if necessary for legibility.

d. If it is found advantageous to place a Directional assembly where it can be read at close range without interference from cross traffic, the most suitable location should be determined by engineering judgment.

See figures 2-7a, b, and c for illustrations of Directional assemblies and other route markings.

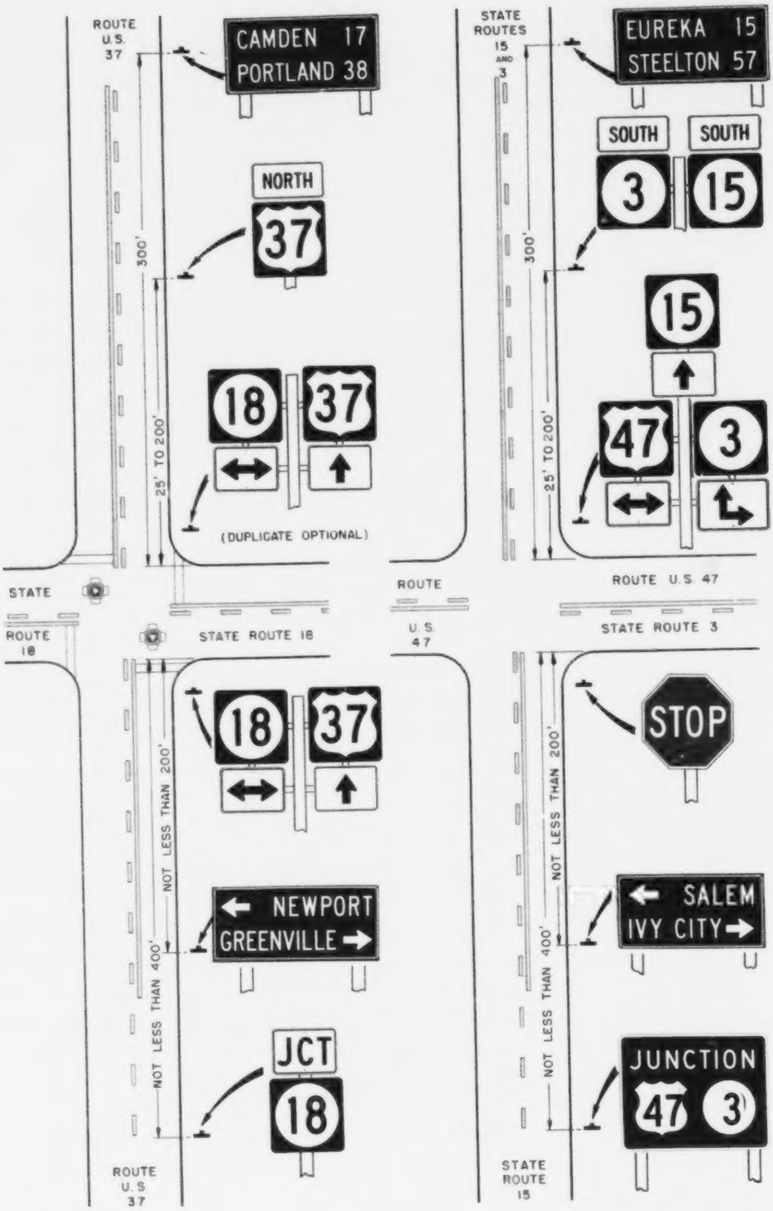

ROUTE U.S. 37
CAMDEN 17
PORTLAND 38
NORTH
37
300'
18
37
25' TO 200'
(DUPLICATE OPTIONAL)
STATE
ROUTE 18
STATE ROUTE 18
18
37
NOT LESS THAN 200'
← NEWPORT
GREENVILLE →
NOT LESS THAN 400'
JCT
18
ROUTE U.S 37
STATE ROUTES 15 AND 3
EUREKA 15
STEELTON 57
SOUTH
3
SOUTH
15
300'
15
47
3
25' TO 200'
ROUTE
U.S. 47
ROUTE U.S. 47
STATE ROUTE 3
STOP
NOT LESS THAN 200'
← SALEM
IVY CITY →
NOT LESS THAN 400'
JUNCTION
47
3
STATE ROUTE 15

Figure 2-7a. Typical route markings at rural intersections (for one direction of travel only).

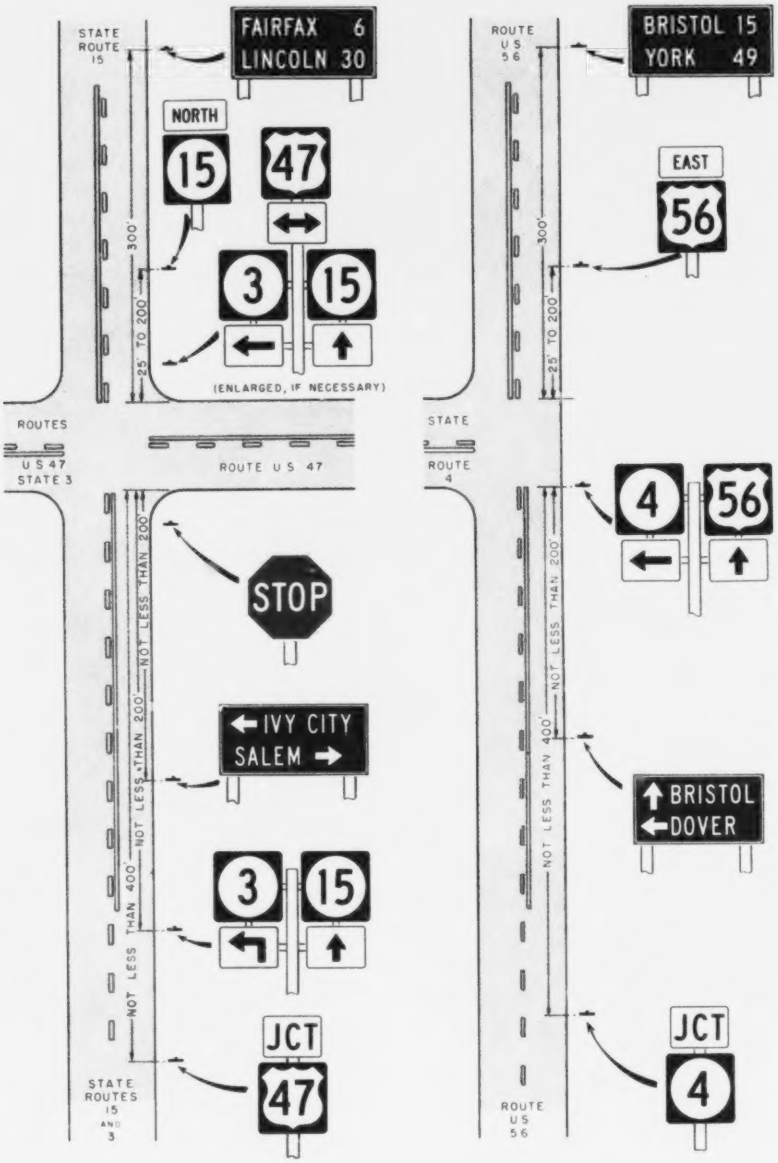

STATE ROUTE 15
FAIRFAX 6
LINCOLN 30
NORTH
15
47
3
15
300'
25' TO 200'
(ENLARGED, IF NECESSARY)
ROUTES
US 47
STATE 3
ROUTE U S 47
NOT LESS THAN 200'
STOP
IVY CITY
SALEM
NOT LESS THAN 200'
3
15
NOT LESS THAN 400'
JCT
47
STATE ROUTES 15 AND 3
ROUTE U.S. 56
BRISTOL 15
YORK 49
EAST
56
300'
25' TO 200'
STATE
ROUTE 4
4
56
NOT LESS THAN 200'
BRISTOL
DOVER
NOT LESS THAN 400'
JCT
4
ROUTE US 56

Figure 2-7b. Typical route markings at rural intersections (for one direction of travel only).

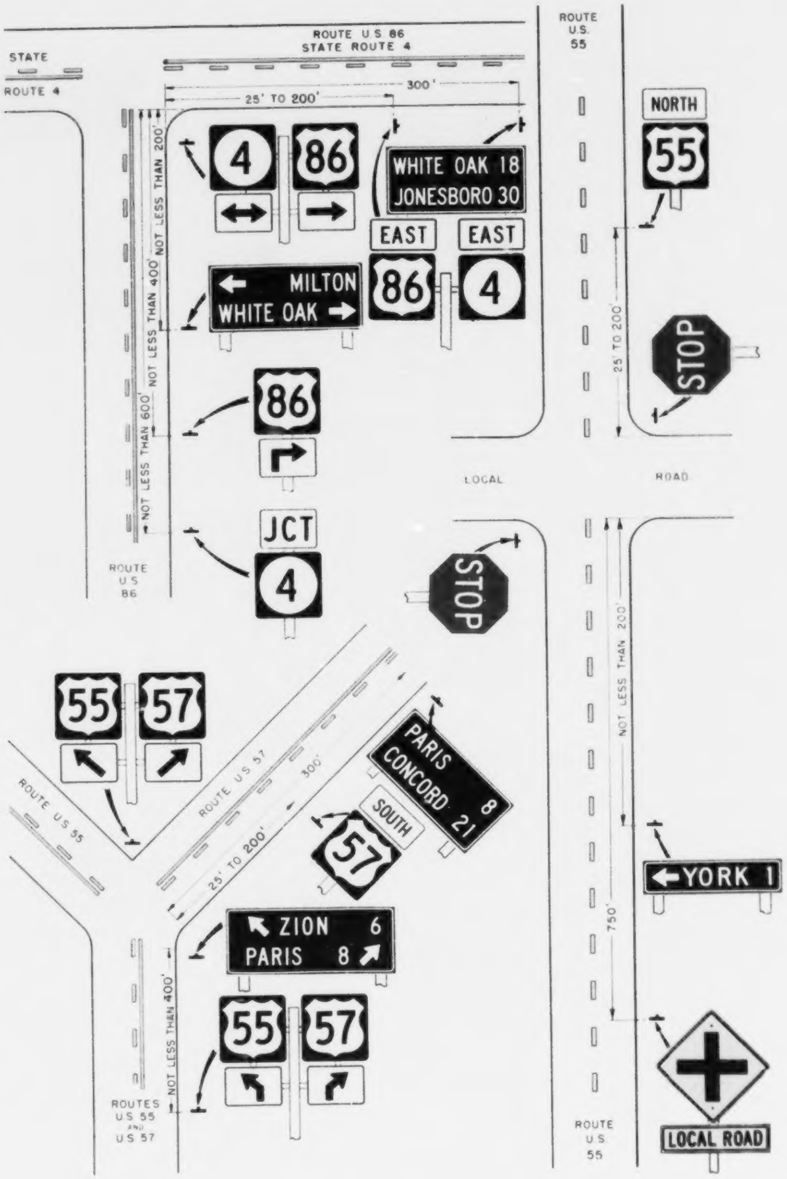

ROUTE U.S. 86
STATE ROUTE 4
STATE
ROUTE 4
ROUTE
U.S.
55
300'
25' TO 200'
NOT LESS THAN 200'
NOT LESS THAN 400'
NOT LESS THAN 600'
4
86
WHITE OAK 18
JONESBORO 30
EAST
EAST
86
4
MILTON
WHITE OAK
NORTH
55
25' TO 200'
STOP
86
LOCAL
ROAD
JCT
4
ROUTE
U.S.
86
STOP
NOT LESS THAN 200'
55
57
ROUTE U.S. 55
ROUTE U.S. 57
300'
25' TO 200'
PARIS
CONCORD 8
21
SOUTH
57
YORK 1
750'
ZION 6
PARIS 8
55
57
NOT LESS THAN 400'
ROUTES
U.S. 55
AND
U.S. 57
ROUTE
U.S.
55
LOCAL ROAD

Figure 2-7c. Typical route markings at rural intersections (for one direction of travel only).

2D-32 Confirming or Reassurance Assemblies

These assemblies shall consist of a Cardinal Direction marker and a Route Marker.

The Confirming assembly shall be erected just beyond intersections of numbered routes. In rural districts, the Confirming assembly should be placed no more than 200 feet beyond the far shoulder or curb line of the intersected highway. In urban districts this distance should be no more than 100 feet.

Reassurance markers should be erected between intersections in urban districts as needed and beyond the built-up area of any incorporated city or town.

Route markers for either confirming or reassurance purposes should be spaced at such intervals as necessary to keep the driver informed of his route. In congested urban areas, the proper location of route markers is extremely important because it is very easy for the traveler to become confused and lose his route. Extreme care should be taken to erect the markers where they can be seen easily. If necessary, they should be located on the far-side of every intersection along a numbered route, or so that at all times a route marker is visible ahead.

2D-33 Trailblazers

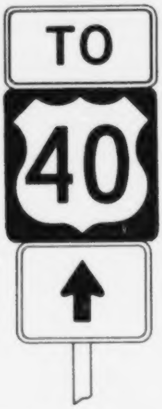
Traffic authorities have found it desirable to provide directional guidance to a particular road facility from other highways in the vicinity. This is accomplished by means of "Trailblazers" erected at strategic locations, usually along major urban arterials, to indicate the direction to the nearest or most convenient point of access. The use of the word TO indicates that the road or street where the marker is posted is not a part of the indicated route, and that a driver is merely being directed progressively to the route.

A Trailblazer assembly shall consist of a TO marker, a Cardinal Direction marker if needed, a Route Marker or a special road facility symbol, and a single-headed Directional Arrow pointed along the route leading to the facility. The Route Marker or symbol should not exceed 24 × 24 inches unless a 3-digit route numeral or equivalent designation must be accommodated, in which case the appropriate enlarged size may be used. The TO marker, Cardinal Direction marker, and Directional Arrow should be of the size specified for auxiliary markers of their respective type.

Trailblazer assemblies may be erected with other route marker assemblies, or alone, in the immediate vicinity of designated facilities.

2D-34 Destination Signs and Distance Signs

In addition to guidance by route numbers it is necessary to supply the traveler information concerning the destinations that can be reached by



Trailblazer Assembly

way of numbered or unnumbered routes. This is done by means of Destination signs and Distance signs.

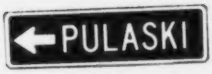
These signs shall have a reflectorized white legend and border on a green background. Reflectorization of the green background is desirable. On any particular highway, reflectorization should be consistently uniform.

Destination names should be in lower-case letters with initial upper-case when letter height exceeds 8 inches.

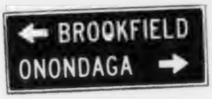
2D-35 Destination Signs (D1-1 to 3)

Except where special interchange signing is prescribed, the Destination sign shall be a horizontal rectangle carrying the name of a city, town, village, or other traffic generator, and a directional arrow. The distance to the place named may also be shown. If several destinations are to be shown at a single point, the several names may be placed on a single panel with an arrow (and the distance, if desired) for each name. If more than one destination lies in the same direction, a single arrow may be used for such a group of destinations, but in any case adequate separation should be made between any destinations or group of destinations in one direction and those in other directions, by suitable design of the arrows, spacing of lines of legend, heavy lines entirely across the panel, or separate panels.

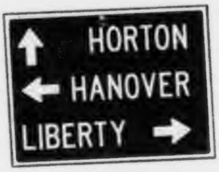
An arrow pointing to the right shall be at the extreme right of the sign, and an arrow pointing left or vertically shall be at the extreme left for signs mounted on the right side of the roadway. The distance figures, if used, shall follow after the destination name. As a general rule, the directional arrows should be horizontal or vertical, but at an irregular intersection a sloping arrow will sometimes convey a clearer indication of the direction to be followed.



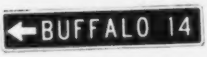
D1-1
Variable Size



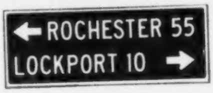
D1-2
Variable Size



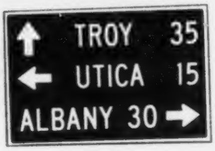
D1-3
Variable Size



D1-1a
Variable Size



D1-2a
Variable Size



D1-3a
Variable Size

The size of the lettering for U.S. and State numbered routes and other major routes shall be no less than that specified in section 2D-6. If several individual name panels are assembled into a group, all panels in the assembly should be of the same length.

Destination signs are generally warranted:

1. At the intersections of U.S. or State numbered routes with Interstate, U.S. or State numbered routes.

2. At points where they serve to direct traffic from U.S. or State numbered routes to the business section of towns, or to other destinations reached by unnumbered routes.

Where a total of three or less destinations are provided on the Advance Guide (2E-26) and Supplemental (2E-28) signs, not more than three names shall be used on a Destination sign. Where four destinations are provided by the Advance Guide and Supplemental signs, not more than four destinations shall be used on destination signing. Four name destination signing shall consist of two separately mounted sign panels one on the left and one on the right, where space permits. Where spacing is critical or all four destinations are in one direction, a single sign assembly may be used. However, a heavy line entirely across the panel or separated sign panels shall be used to adequately separate destinations. The next most important destination lying straight ahead should be at the top of the sign or assembly, and below it the next important destinations to the left and to the right, in that order. In the case of overlapping routes, there should be shown only one destination in each direction for each route. If there is more than one destination shown in any direction, the name of the nearest city or town shall appear above that of any farther away. The destination shown for each direction should ordinarily be the next county seat or the next principal city, rather than a more distant destination. II-8 (c)

2D-36 Location of Destination Signs

In rural districts, Destination signs should be located 200 feet or more in advance of the intersection, and following any Junction or Route Turn assemblies that may be required. In urban districts shorter distances may be justified. The Destination sign is of lesser importance than the Junction, Turn or Directional assemblies; therefore, when sign spacing is critical the Destination sign may be eliminated.

Height and lateral placement of Destination signs shall be in accordance with the general standards for sign erection.

Figures 2-7a, b and c (pages 2D-16 to 2D-18) show the use of Destination signs at rural intersections.

2D-37 Distance Sign (D2-1 to 3)

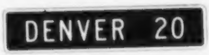
The Distance sign shall be a horizontal rectangle of a size appropriate to the required legend, carrying the names of not more than three cities, towns, villages or other traffic generators, and the distance (to the nearest mile) to those places.

The top name should be that of the next place on the route having a post office, railroad station, route number or name of an intersected highway, or other significant geographical identity. The lowermost name should be that of the next major destination or "control city." If three destinations are shown, the middle line should be used to indicate communities of general interest along the route, or important route junctions. The choice of names for this middle line can be varied on successive Distance signs to give motorists maximum information concerning communities served by the route.

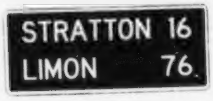
The "control city" should remain the same on all successive signs throughout the length of the route until that destination is reached. There are circumstances, however, under which more than one distant point may properly be designated, as for example, where the route divides at some distance ahead to serve two destinations of similar importance. If these two destinations cannot appear on the same sign, alternating of the two names may be justified on succeeding signs. On a route continuing into another state, destination(s) in the adjacent state should be shown.

2D-38 Location of Distance Signs

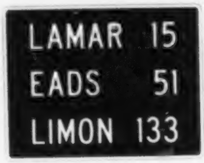
Distance signs should be erected on important routes leaving municipalities, and just beyond intersections of numbered routes in rural areas.



D2–1
Variable Size



D2–2
Variable Size



D2–3
Variable Size

Distance signs shall be placed on the right-hand side of the road facing traffic leaving the municipality, approximately 500 feet outside of the municipal limits, or at the edge of the built-up district if it extends beyond the corporation limits. Where overlapping routes separate a short distance from the corporation limits, the Distance sign at the corporation limits should be omitted, and instead should be erected 300 feet beyond the separation of the two routes.

Where, just outside of an incorporated municipality, two routes are concurrent and continue concurrently to the next incorporated municipality, the top name on the sign placed at such a point should be that of the place where the routes separate; the lower name should be that of the city in which the greater part of the through traffic is interested.

Distance signs shall be erected in accordance with the general standards for sign erection.

Figures 2-7a, b and c (pages 2D-16 to 2D-18) show the use of Distance signs at rural intersections.

2D-39 Street Name Sign (D3)

Street Name signs should be erected in urban areas at all street intersections regardless of other route marking that may be present and should be erected in rural districts to identify important roads not otherwise marked.

Lettering on street name signs should be at least 4 inches high. Supplementary lettering to indicate the type of street (e.g., Street, Avenue, Road, etc.) or section of city (e.g., N.W.) may be in smaller lettering, at least 2 inches high. Conventional abbrevations are acceptable except for the street name itself.

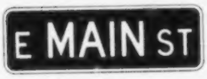
A symbol or letter designation may be included to identify the governmental jurisdiction. If used, the length of the designation shall not exceed the height of the sign, and should be positioned to the left of the street name.

The Street Name sign should be reflectorized or illuminated. The legend and background shall be of contrasting colors and should have a white message and border on a green background.

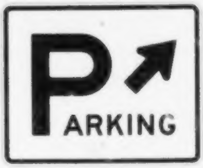
In business districts and on principal arterials, Street Name signs should be placed at least on diagonally opposite corners so that they will be on the far right-hand side of the intersection for traffic on the major street. Signs naming both streets should be erected at each location. They should be mounted with their faces parallel to the streets they name.

In residential districts at least one Street Name sign should be mounted at each intersection.

On more important intersection approaches a supplemental advance Street Name sign may be erected separately or below an intersection warning sign. When combined with a yellow diamond sign, the color should be a black message on a yellow background.



D3
Variable Size



D4
30" x 24"

2D-40 Parking Area Sign (D4-1)

The Parking Area sign may be used where it is desired to show the direction to a nearby parking area for use by the general public. The sign shall be a horizontal rectangle of a standard size of 30 × 24 inches with a smaller size of 18 × 15 inches for minor, low-speed streets. It shall carry the word PARKING, with the letter P five times the height of the remaining letters, and a directional arrow. The legend and border shall be green on a reflectorized white background.

If used, the Parking Area sign should be erected on major thoroughfares at the nearest point of access to the parking facility and where it can help relieve the local streets of traffic seeking a place to park. In general, the sign should not be used more than three or four blocks from the parking area. It shall be mounted in accordance with the general specifications for the erection of signs (secs. 2A-23, 24).

2D-41 Park and Ride Signs (D4-2)

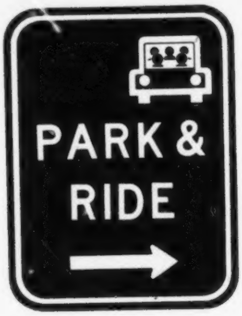
Park and Ride signs may be used where it is desirable to direct motorists to park and ride facilities. The signs shall contain the word message Park & Ride and direction information (arrow or word message). They may contain the local transit logo and/or carpool symbol within the sign border.

If used, the local transit logo and/or carpool symbol shall be located in the top part of the sign above the message Park & Ride. In no case shall the vertical dimension of the local transit logo and/or carpool symbol exceed 18 inches.

If the function of the parking facility is to provide parking for persons using public transportation, the local transit logo symbol should be used on the guide sign. If the function of the parking facility is to serve carpool riders, the carpool symbol should be used on the guide sign. If the parking facility serves both functions, both the logo and carpool symbol should be used.

These signs shall have a reflectorized white legend and border on a rectangular green background. The carpool symbol shall be as shown in D4-2. The transit logo shall be its standard color. To increase target value and contrast for the transit logo it may be necessary to include the logo within a white border or use a white background for the logo. The important item is that the local transit logo retain its distinctive color and shape.

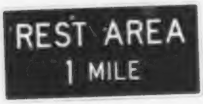
If used, the Park and Ride signs shall be mounted in accordance with the general specifications for the erection of signs (secs. 2A-23, 24).



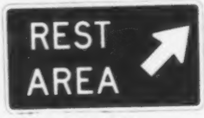
D4-2
36″ × 48″

2D-42 Rest Area Signs (D5-1 to 5)

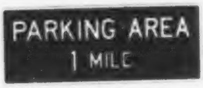
It is common practice on rural highways to provide roadside parks or rest areas where a traveler may stop safely away from passing traffic. It is desirable to erect word messages or symbols in advance of such areas to permit the driver to reduce speed and leave the highway safely if he desires to stop. Messages such as REST AREA (1) MILE (D5-1), PARKING AREA (1) MILE (D5-3), or ROADSIDE TABLE (D5-5) are typical. Other messages such as ROADSIDE PARK 1000 FEET, PICNIC TABLE ¼ MILE, or PARKING AREA ½ MILE are also appropriate. The REST AREA sign shall be used only where parking and restroom/toilets are available. Signs for this purpose shall have reflectorized white letters, symbols and border on a blue background. II-6


REST AREA
1 MILE

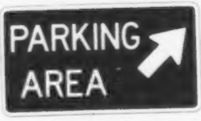
D5-1



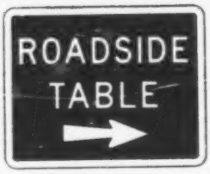
D5-2


PARKING AREA
1 MILE

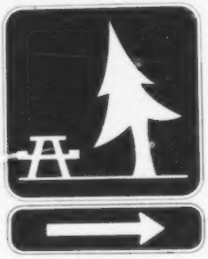
D5-3


PARKING
AREA

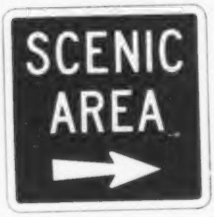
D5-4


ROADSIDE
TABLE

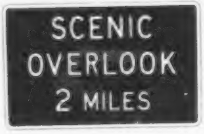
D5-5



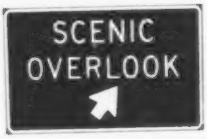
D5-5a
24 x 24"
24" x 6"


SCENIC
AREA

D6-1


SCENIC
OVERLOOK
2 MILES

D6-2


SCENIC
OVERLOOK

D6-3

2D-43 Scenic Area Signs (D6-1 to 3)

Scenic areas may be marked by signs carrying the message SCENIC AREA, SCENIC VIEW or the equivalent together with appropriate directional information. The design of the signs should be consistent with that specified for rest areas and should have reflectorized white letters, symbols, and border on a blue background. An advance sign and an additional sign at the turnoff point are usually required for this kind of attraction.

2D-44 Recreational and Cultural Interest Area Signs (D7-1, 2)

Recreational and cultural interests are attractions or traffic generators that are open to the general public for the purpose of play, amusement or relaxation used to refresh the body or mind (RECREATION) or for the training and refining of the mind, emotions, manners, taste, etc. (CULTURAL INTERESTS). Recreational attractions would include such facilities as parks, race tracks, and ski areas, while examples of cultural attractions would include museums and art galleries.

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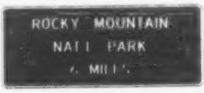
Where recreational and cultural interest areas are a significant destination on a numbered highway route, special signs may be posted for such areas, at least to the first point at which an access road intersects the highway. When recreational or cultural interest area destinations are used on primary or supplemental guide signs such signs may be either rectangular or trapezoidal in shape. When the trapezoidal shape is used, it shall have reflectorized white letters, symbols and border on a brown background. The order of preference for use of the shape and color is as follows: (1) Rectangular, white on green; (2) rectangular, white on brown, or; (3) trapezoidal, white on brown. (sec. 2F-41)

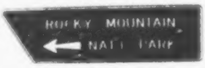
Recreational and cultural interest guide signs erected and maintained by a public park agency along roads maintained by the agency, shall conform to the standards prescribed in this section. Where another public agency maintains the road system in the park, standards prescribed in this section may be used on guide signs when agreed to by the agency maintaining the road system.

On publicly operated highways within a recreational or cultural interest area that are not primarily for intrapark traffic, guide signing shall be in conformance with the other sections of this Manual. Where a demonstrable need exists for additional types of guide signing not provided for in the Manual, the public agency may allow installation of symbols conforming to the National Park Service standards.

Linear parkway type highways that merely function as arterial connectors without providing access to recreational or cultural interest areas do not qualify for the use of brown and white guide signing.



D7-1
Variable Size



D7-2
Variable Size

2D-45 Weigh Station Signing (D8-1 to 3)

The general concept for Weigh Station signing is similar to Rest Area signing, since in both cases traffic using either area remains within the right-of-way.

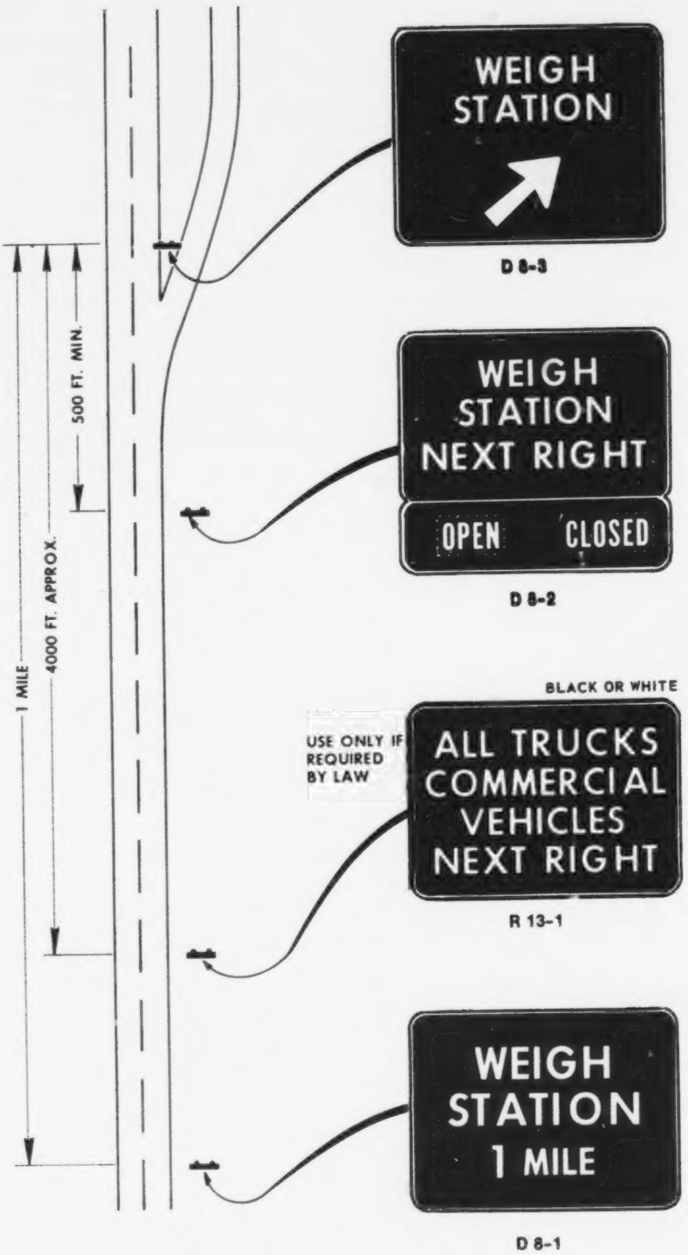

WEIGH
STATION
D 8-3
500 FT. MIN.
WEIGH
STATION
NEXT RIGHT
OPEN
CLOSED
D 8-2
4000 FT. APPROX.
1 MILE
BLACK OR WHITE
USE ONLY IF
REQUIRED
BY LAW
ALL TRUCKS
COMMERCIAL
VEHICLES
NEXT RIGHT
R 13-1
WEIGH
STATION
1 MILE
D 8-1

Figure 2-8. Weigh Station signing.

The standard installation for Weigh Stations shall include three basic signs:

1. Advance sign (D8-1)
2. Exit Direction sign (D8-2)
3. Gore sign (D8-3)

The location of these signs is shown in figure 2-8. Where State law requires a regulatory sign in advance of the Weigh Station, a fourth sign (sec. 2B-42) may be located following the Advance sign. Design details for these signs are included in Standard Highway Signs. *

The Exit Direction sign (D8-2) or the Advance sign (D8-1) should display, either within the sign border or on a supplemental panel, the changeable message OPEN or CLOSED. Remote control of the changeable message is recommended, but provision may be made for changing the message manually.

2D-46 General Service Signs (D9-1 to 14)

II-20 (c)
Rev. 3

On conventional highways commercial services such as gas, food and lodging are generally within sight and available to the traveler at reasonably frequent intervals along the route. Consequently, there is not expected to be much need on this class of roads for special signs calling attention to these services. Moreover, it is assumed that service signing will not be required in urban areas except for hospitals, Police assistance, tourist information centers and camping.

II-20 (c)
Rev. 3

It is quite likely, however, that general service signs will be desirable or necessary where such services are infrequent, and are to be found only on an intersecting highway or crossroad. Under such conditions, States that elect to provide service signing should establish a statewide policy or warrant for its use and criteria for the availability of services, based on national guidelines. Local jurisdictions for such signing should follow the State policy for the sake of uniformity.

General service signs, if used at intersections, shall carry legends for one or more of the following services: Food, Gas, Lodging, Camping, Phone, Hospital, Diesel, LP-Gas, or Tourist Information, along with a directional message. The service legends may be either symbols or word messages, but the intermixing of symbols and word messages on one sign shall not be permitted. Formats for displaying different combinations of these services are presented in section 2F-33.

II-65(c)
Rev. 4

The International Symbol for Access for the Handicapped Sign (D9-6) may be used beneath General Service signs where paved ramps and restroom facilities accessible to, and usable by, the physically handicapped are provided.

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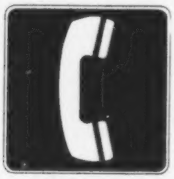
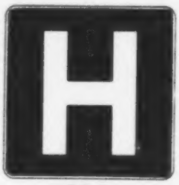
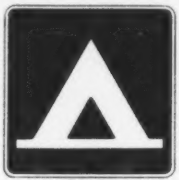
* Available from GPO, see page ii.



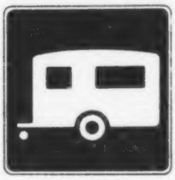
D9-1
24" x 24"



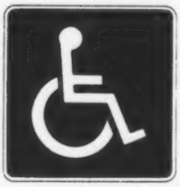
D9-2
24" x 24"



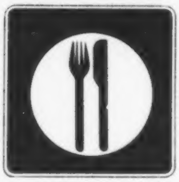
D9-3
24" x 24"



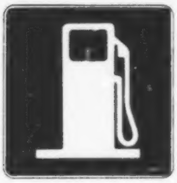
D9-3a
24" x 24"



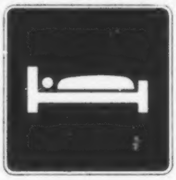
D9-6
24" x 24"



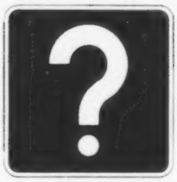
D9-8
24" x 24"



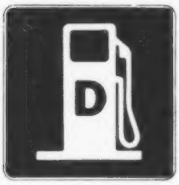
D9-7
24" x 24"



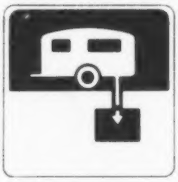
D9-9
24" x 24"



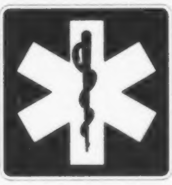
D9-10
24" x 24"



D9-11
24" x 24"



D9-12
24" x 24"



D9-13
24" x 24"

II-46 (c)
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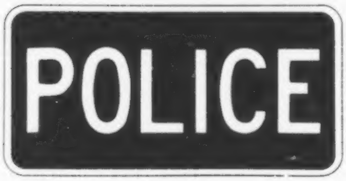
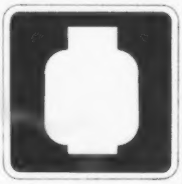


D9-14
12" x 24"



D9-15
24" × 24"

II-65(c)
Rev. 4

Where the distance to the next point at which services are available is 10 miles or more, a sign NEXT SERVICES (12) MILES may be used as a separate panel mounted under the General Service signs.

The Recreational Vehicle Sanitary Station sign (D9-12) may be used as needed to indicate the availability of facilities designed for the use of dumping wastes from recreational vehicle holding tanks.

In advance of roadside turnouts or rest areas, a Trash Receptacle Symbol sign (D9-4) may be placed provided it does not compete with other more important regulatory, warning, and directional signs.

A Channel 9 Monitored sign (D12-3) may be installed as needed. Only official government agencies or their designee may be shown as the monitoring agency on the sign. (see sec. 2F-37).

II-12 (c)
Rev. 2

All service signs, and supplemental panels, shall have reflectorized white letters, symbols and border on a reflectorized or opaque blue background and are to be erected at a suitable distance in advance of the turnoff point or intersecting highway.

The Emergency Medical Services (EMS) Symbol Sign (D9-13) may be used to identify medical service facilities that have been included in the EMS system under criteria established by the National Highway Traffic Safety Administration. The EMS Symbol sign shall not be used to identify services other than qualified hospitals, ambulance stations, and qualified free standing emergency medical treatment centers. In all cases when used, the EMS Symbol must be supplemented by a sign identifying the type of service provided. For instance, the EMS Symbol sign may be used above the HOSPITAL or H symbol sign or above a panel with either the legend AMBULANCE STATION or EMERGENCY MEDICAL CARE. The EMS Symbol may also be used to supplement telephone, CB monitoring, or POLICE signs. The legend EMERGENCY MEDICAL CARE shall not be used for services other than qualified free standing emergency medical treatment centers.

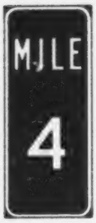
II-46 (c)
Rev. 3

Each State should develop guidelines for the implementation of the EMS symbol sign.

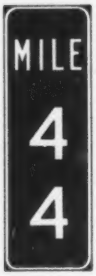
2D-47 Mileposts (D10-1 to 3)

To assist the driver in estimating his progress, to provide a means for identifying the location of emergency incidents, and to aid in highway maintenance and servicing, mileposts may be erected along any section of a numbered highway route. Zero distance should begin at the south and west state lines and at junctions where routes begin.

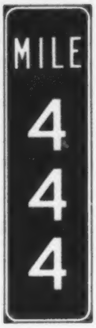
The distance numbering shall be continuous for each route within a State, except where overlaps occur. With overlapped routes, continuity shall be established for only one of the routes. On the route without milepost continuity, the first milepost beyond the overlap should indicate



D10–1
10" x 18"



D10–2
10" x 27"



D10–3
10" x 36"

the total distance traveled on the route so that a motorist may have a means of correlating his travel distance between mileposts with that shown on his odometer.

Milepost signs shall be vertical panels with 6-inch white numerals, a border and the legend MILE in 4-inch letters on a green background and shall be reflectorized. Milepost signs may be placed up to 30 feet from the edge of pavement. Milepost signs located in line with delineator posts shall have the bottom of the sign at the same height as the delineator (see sec. 3D–5).

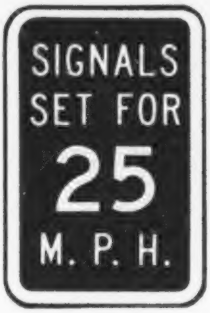
Small size 6 × 9 inch mileposts with 4-inch numerals, without the legend MILE, may be used on low volume, low speed, rural unnumbered roads in lieu of the D–10 series.

For divided highways, distance measurement shall be made on northbound and eastbound roadways. The mileposts for southbound and westbound roadways shall be set at locations directly opposite. When a milepost cannot be erected in its correct location, it may be moved in either direction as much as 50 feet. If it cannot be placed within 50 feet of its correct location, it should be omitted.

While mileposts serve as a guide for motorists, they also provide a means of identifying traffic accident locations and sections of highway for maintenance or other purposes. To further enhance the usefulness of this system, delineators may be spaced at 1/10 or 1/20 of a mile, and can be marked in fractions of a mile by stencil on the back of the delineator or post or by a small plate on the delineator post. This plate shall not be considered as a milepost, therefore will not be green and white in color. The numeral shall be small and preferably on the back side of the post or delineator.

2D–48 Traffic Signal Speed Sign (I1–1)

The Traffic Signal Speed sign, reading SIGNALS SET FOR (25) M.P.H., may be used to indicate a section of highway on which the traffic



I1-1
12" x 18"

control signals are coordinated into a pretimed progressive system and timed for a specified speed at all hours during which they are operated on a stop-and-go basis. Where used, the sign should be mounted on, or as near as possible to, each signal face where the timed speed changes, and at intervals of several blocks throughout any section where the timed speed remains constant.

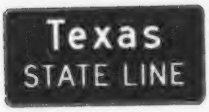
This sign shall be a minimum of 12 × 18 inches with the longer dimension vertical. It shall always have a white reflectorized message and border on a green reflectorized background.

2D-49 General Information Signs (I Series)

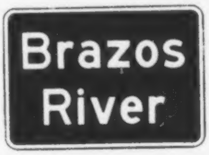
Of interest to the traveler, though not directly necessary for guidance, are numerous kinds of information that may properly be conveyed by information signs. They include such items as State lines, city limits, and other political boundaries, time zones, stream names, elevations, landmarks and similar items of geographical interest. Such signs should not be installed within a series of guide signs or at other equally critical locations, unless there are specific reasons for orienting the highways user or identifying control points for activities that are clearly in the public interest. On all such signs the design should be simple and dignified, devoid of any advertising and in general conformance with other guide signing.

II-78(c) Rev. 4 An informational symbol sign (I-5 thru I-8) may be used to identify a route leading to a transportation or general information facility, and to provide additional guidance to the facility. The symbol sign may be supplemented by an educational plaque where necessary; also, the name of the facility may be used if needed to distinguish between two similar facilities.

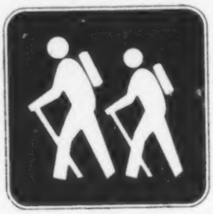
Political jurisdiction logos may be placed on political boundary General Information signs; however, the predominant characteristics of the sign



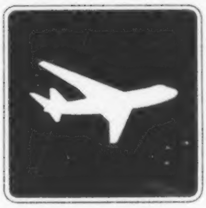
I-2
Variable Size



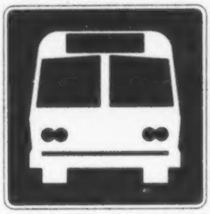
I-3
Variable Size



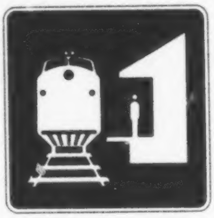
I-4
24" x 24"



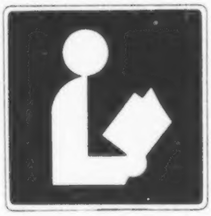
I-5
24" × 24"



I-6
24" × 24"



I-7
24" × 24"



I-8
24" × 24"

will be a white legend on a green rectangular shaped background. The logo may have different colors and shapes but should be simple and dignified, devoid of any advertising.

All General Information signs shall conform to the general standards for guide signs, and shall be reflectorized where required to provide nighttime visibility.

These signs shall be erected in accordance with the general specifications (secs. 2A-23, 24).

2D-50 Signing of Named Highways

Federal and State legislative bodies will from time to time adopt an act or resolution memorializing a highway, bridge or other component of highway. Such memorial names shall not appear on or along a highway, bridge or other component, but memorial plaques to recognize such a destination may be erected in rest areas, scenic overlooks or other appropriate points inconspicuously located relative to vehicle operators' viewing.

Guide signs may contain names if the purpose is to enhance driver communication and guidance; however, they are to be considered as supplemental information to route numbers. Highway names are not to replace official numeral designations. Memorial names shall not appear independently on supplemental signs nor on any other information sign either on or along the highway or its intersecting routes.

The use of route markers will be restricted to markers officially used for guidance of traffic in accordance with the Manual and the "Purpose and Policy" statement of American Association of State Highway and Transportation Officials which applies to Interstate and U.S. numbered routes.

The signing for unnumbered routes having major importance to proper guidance of traffic is permissible if carried out in accordance with the aforementioned policies. For unnumbered highways, a name to enhance route guidance may be used where the name is applied consistently throughout its length. Not more than one name should be used to identify any highway whether numbered or unnumbered.

2D-51 Trail Markers

Trail Markers are informational plaques or shields designed to provide the traveling public with route guidance in following a trail of particular cultural, historical, or educational significance. These markers satisfy an information need on the part of certain travelers but primary guidance should be in the form of printed literature and strip maps rather than highway signing.

Except on the Interstate System, trail markers signs may be erected when they have been approved by and are under the control of the State highway organization. Control of such markers by a county or city highway department is also satisfactory. The installation must be consistent with highway safety practices and with practices governing signs of this general nature.

2D-52 Crossover Signs (D13-1, D13-2)

The CROSSOVER sign may be erected on divided highways to mark median openings not otherwise marked by Warning or Guide signs. It

II-7 (c)
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shall not be used to mark median openings that are restricted to the use of official or authorized vehicles. The sign shall be a horizontal rectangle of appropriate size to carry the word CROSSOVER and a horizontal directional arrow. If used, it should be erected immediately beyond the median opening either on the right side of the roadway or in the median.

The Advance Crossover sign may be erected in advance of the CROSSOVER sign to provide advance information of the crossover. The sign shall be a horizontal rectangle of appropriate size to carry the word CROSSOVER and a distance. The distance shown should be either 1, ½, or ¼ mile, unless unusual conditions require some other distance. If used, the sign should be erected on the right side of the roadway at approximately the distance shown.

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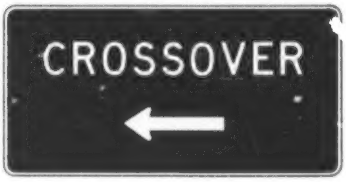
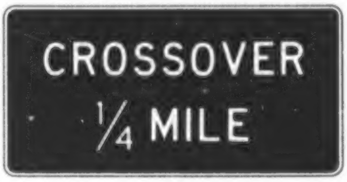
CROSSOVER signs shall have a white reflectorized legend and border on a green background.



D13-1
72"×36



D13-2
72"×36"

E. GUIDE SIGNS—EXPRESSWAY

2E-1 Scope of Expressway Guide Sign Standards

Expressways are divided arterial highways for through traffic with partial control of access and generally with grade separations at major intersections. The standards prescribed herein shall apply to any expressway. Some of the material contained in this Section also applies to "Freeways" and it is so referenced in Part II-F.

2E-2 Application

Expressways call for an intermediate level of signing more advanced than that prescribed for Conventional Roads (Part II-D), but less demanding in their requirements and specifications than Freeway signing standards (Part II-F). Since there are many geometric design variables to be found in existing expressways, a signing concept commensurate with prevailing conditions must be the primary consideration. Whenever possible, expressway signing should be planned at the design stage.

2E-3 General Standards

Basically, expressway signs should be designed so that they are legible to drivers approaching them, and readable in time to permit proper responses. On arterials and facilities of expressway design, this usually means (a) high visibility, (b) large lettering and symbols, and (c) short legends for quick comprehension. Standard shapes and colors are required so that traffic signs can be promptly recognized.

Although the sections which follow deal specifically with expressway guide signs, it must be remembered that the dimensions of regulatory and warning signs will have to be suitably enlarged for the expressway traveler in consideration of multiple traffic lanes and higher operating speeds. Moreover, ground signs in these categories may have to be posted in the median as well as at the right-hand side of the roadway as traffic in the right-hand lane may obstruct the view to the right.

Reference should be made to Part II-A for pertinent data on sign shapes, sign borders, variable messages, overhead sign warrants, height and lateral clearance. Standard messages and symbols for regulatory and warning signs will also apply (Parts II-B and II-C). Sizes for regulatory and warning signs are given in the Standard Highway Signs booklet.*

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*Available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590

2E-4 Functions of Expressway Guide Signs

Guide signs on expressways serve distinct functions as follows:

1. Give directions to destinations, or to streets or highway routes, at intersections or interchanges.
2. Furnish advance notice of the approach to intersections or interchanges.
3. Direct drivers into appropriate lanes in advance of diverging or merging movements.
4. Identify routes, and directions on those routes.
5. Show distances to destinations.
6. Indicate access to general motorist services, rest, scenic, and recreational areas.
7. Provide other information of value to the driver.

2E-5 Color of Expressway Guide Signs

Guide signs on expressways except as noted herein shall have white letters, symbols, and borders on a green background. Color requirements for route markers and trailblazers, signs with blank-out or variable messages, signs for services, rest areas, park and recreational areas, and for certain miscellaneous signs are specified in the individual sections dealing with the particular sign or sign group. Specifications for standard highway sign colors are available.*

2E-6 Reflectorization or Illumination

Letters, numerals, symbols, and borders shall be reflectorized. The background of expressway guide signs may be reflectorized or nonreflectorized. However, the mixing of signs with reflectorized and nonreflectorized backgrounds in the same general area should be avoided.

In general, where there is no serious interference from extraneous light sources, reflectorized signs will usually be adequate. However, on expressways where much driving at night is done with low beam headlights, the amount of headlight illumination incident to an overhead sign display is relatively small. Therefore, all overhead sign installations should normally be illuminated. The type of illumination chosen should provide effective and reasonably uniform illumination of the sign face and message. When a sign is internally illuminated the requirement for reflectorized legend and borders does not apply.

2E-7 Size of Expressway Guide Signs

Sign size must be fixed primarily in terms of the length of the message and the size of the lettering necessary for proper legibility. On a given expressway it is desirable, for esthetic and economic reasons, to keep to a minimum number of sizes.

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*Available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590

Under some circumstances, particularly for overhead signs, the available space must be considered. A sign mounted over a particular roadway lane to which it applies may have to be limited in horizontal dimension to the width of the lane, so that another sign may be placed over an adjacent lane. The necessity to maintain proper vertical clearance may place a further limitation on the size of the overhead sign and the copy that can be accommodated.

2E-8 Number of Signs at an Overhead Installation

When overhead signs are warranted, as is set forth in section 2A-22, it is desirable to limit the number of signs at these locations to only those essential in communicating pertinent destination information to the motorist. Typically, exit direction signs for a single exit and the advance guide signs will only need one panel with one or two destinations.

At other overhead locations it may be necessary to erect more than one sign to advise of a multiple exit condition at an interchange. Possibly, due to complex or unusual geometrics of the roadway, ramp, or crossing roadway, it may be necessary to provide additional panels with confirmatory messages to guide the motorist properly. However, it should be recognized that drivers have limited time to read and comprehend sign messages. In no case should there be more than three signs displayed at any one location, including regulatory or warning signs either on the overhead structure or its support.

The use of regulatory signs, such as speed limits, in conjunction with overhead guide sign installations, is not recommended.

2E-9 Amount of Legend on Expressway Guide Signs

Regardless of letter size, the legend on an expressway guide sign must be kept to a minimum. Two destinations and the directional copy are as much as most drivers can comprehend readily at high speed. For this reason, on any single major guide sign, not more than two destination names or street names ordinarily should be shown. A city name and street name on the same sign should be avoided. Directional copy, not exceeding three lines, may include symbols, route numbers, arrows, cardinal directions, and exit instructions. Where two or more signs are placed on the same supports, it is desirable to limit destinations or names to one per sign, or to a total of three in the display. Indiscriminate use of supplemental signs should be avoided (sec. 2E-28).

2E-10 Style of Lettering

The style of lettering to be used on expressway guide signs shall be one of the following two types provided in the Standard Alphabets for Highway Signs and Pavement Markings*

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* Available from the Federal Highway Administration (HTO 20), Washington, D.C. 20590

1. Upper-case letters for all word legend; or
2. Lower-case letters with initial upper-case letters for all names of places, streets, and highways and upper-case letters for other word legend.

2E-11 Size of Lettering

Word messages in the legend of expressway guide signs shall be in letters at least 8 inches high. Larger lettering is necessary for major guide signs at or in advance of interchanges and for all overhead signs. Recommended numeral and letter sizes according to interchange classification, type of sign and component of sign legend are shown in table II-1. These sizes are to be regarded as minimums. Freeway lettering sizes (table II-2, page 2F-5) are considered applicable to expressways designed closely to freeway geometrics.

For use with lower-case letters, the initial upper-case letters shall be about 1⅓ times the "loop" height of the lower-case letters.

Lettering size on expressway signs is to be the same for both rural and urban conditions. Large easy-to-read copy is just as necessary on urban sections as on rural highways because of the more complex traffic pattern.

Table II-1 Letter and Numeral Sizes for Expressway Guide Signs

A. *Advance Guide, Exit Direction, and Overhead Signs*

	*Major**				
	*Category (a)**	*Category (b)**	*Intermediate**	*Minor**	*Overhead*
Exit Panel					
Word	10"	10"	10"	8"	10"
Numeral	15"	15"	15"	12"	15"
Letter	15"	15"	15"	12"	15"
Route Marker Interstate					
Numeral	18"				18"
Shield					
(1-2 Digit)	36" x 36"				36" x 36"
(3 Digit)	45" x 36"				45" x 36"
U.S. or State Marker					
Numeral	18"	18"	18"	12"	18"
Shield					
(1-2 Digit)	36" x 36"	36" x 36"	36" x 36"	24" x 24"	36" x 36"
(3 Digit)	45" x 36"	45" x 36"	45" x 36"	30" x 24"	45" x 36"
or Alternate (Ex: U.S. 56)					
Initials	15"	12"	12"	10"	12"
Numeral	18"	15"	15"	12"	15"
Cardinal Direction					
Word	15"	12"	10"	8"	12"
Name of Place, Street, or Highway					
Word	20"/15"	16"/12"	13.3"/10"	10.6"/8"	16"/12"

Table II-1 Letter and Numeral Sizes for Expressway Guide Signs—Cont.

	Major*		Intermediate*	Minor*	Overhead
	Category (a)*	Category (b)*			
Distance					
Numeral	18″	15″	12″	10″	15″
Fraction	12″	10″	10″	8″	10″
Word	12″	10″	10″	8″	10″
Action Message					
Word	10″	10″	10″	8″	10″

*See Section 2E-23, Expressway Interchange Classification

B. *Gore Signs*

At major and intermediate interchanges	
Word	10″
Numeral & Letter	12″
At minor interchange	
Word	8″
Numeral & Letter	10″

C. *Pull Thru Signs*

Destination Message	
Word	13.3″/10″
Route Marker as Message	
Cardinal Direction	10″
Route Marker	36″×36″

D. *Supplemental Guide Signs*

Exit Number	
Word	8″
Numeral	12″
Letter	12″
Place name	10.6″/8″
Action message	8″

E. *Variable Message Signs***

Place name	10.6″/8″
Advisory Message	10.6″/8″
Action Message	
Word	8″
Numeral(s)	8″

**Variable message signs may often require larger legends or the use of all capital letters. The sizes shown here are minimum and larger sizes may be used depending on needs.

F. *Interchange Sequence Signs*

Word	10.6″/8″
Numeral	10″
Fraction	8″

G. *"Next—Exits" Signs*

Place name	10.6″/8″
NEXT—EXITS	8″

TABLE II-1 Letter and Numeral Sizes for Expressway Guide Signs—Cont.

	Major*		Inter-mediate*	Minor*	Overhead
	Category (a)*	Category (b)*			
H. *Distance Signs*					
Word					8″/6″
Numeral					8″
I. *General Services Signs*					
Exit Number					
Word					8″
Number					12″
Letter					12″
Services					8″
J. *Rest Area and Scenic Area Signs*					
Word					10″
Distance					
Numeral					12″
Fraction					8″
Word					10″
Action Message					
Word					10″
K. *Mileposts*					
Word					4″
Numeral					10″
L. *Boundary and Orientation Signs*					
Word					8″/6″
M. *"Next Exit" and "Next Services" Signs*					
Word					8″
Numeral					8″
N. *"Exit Only"*					
Word					12″

Note: (/) Slanted bar signifies separation of upper-case and lower-case alphabets.

2E-12 Interline and Edge Spacing

Interline spacing of upper-case letters should be approximately three-fourths the average of upper-case letter heights in adjacent lines of letters.

The spacings to the top and bottom borders should be approximately equal to the average of the letter height of the adjacent line of letters. The lateral spacing to the vertical borders should be essentially the same as the height of the largest letter.

2E-13 Abbreviations

Abbreviations are to be kept to a minimum; however, they are useful when complete destination messages produce signs excessively long.

When used, abbreviations should be unmistakably recognized by motorists. In the case of cardinal directions used with route markers on major guide signs, the words NORTH, SOUTH, EAST, and WEST are not to be abbreviated. Branch or divided routes are not desirable and not in keeping with AASHTO Policy on U.S Numbered Highways. There should not be any use of a suffix letter as an integral part of the route designation.

2E-14 Symbols

Symbol designs should be essentially like those shown in this Manual. Educational plaques (word messages) may be used below symbol signs where needed. A special effort should be made to balance legend components for maximum legibility of the symbol with the rest of the sign legend.

2E-15 Arrows for Interchange Guide Signs

On all exit direction signs, both overhead and ground mounted, arrows shall be upward slanting and be located on the appropriate side of the sign.

Downward pointing arrows are lane assignment arrows and shall be used only for overhead guide signs to prescribe the use of specific lanes for traffic bound for a destination or route that can be reached only by being in the lane(s) so designated. These arrows may be tilted where it is desired to emphasize the separation of roadways.

Examples of arrows for use on guide signs are shown in figure 2-6 (page 2D-4). Detailed dimensions of arrows are provided in the appendix of the Standard Highway Signs booklet.*

2E-16 Viewing Factors

Proper placement of signs, either overhead or on the ground, can greatly enhance the effectiveness of an installation. Sign faces should always be oriented to minimize specular reflection. Decisions on the placement of signs, both ground-mounted and overhead, should be related to the site conditions. Where highway design features and other appurtenances are affected, sign placement should be jointly planned for best service and safety.

2E-17 Overhead Sign Installations

Overhead sign installations will have value at many locations on expressways. Specifications for the design and construction of structural supports for highway signs have now been standardized by the American Association of State Highway and Transportation Officials.**

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* Available from the Federal Highway Administration (HTO-20) Washington, D.C. 20590

**Available from the American Association of State Highway and Transportation Officials, Washington, D.C. 20004

Factors justifying the erection of overhead signs are enumerated in section 2A-22.

Overcrossing structures can often serve for the support of overhead signs, and may be the only practical location that will provide adequate viewing distance. Use of these structures as sign supports will eliminate the need for sign supports along the roadside. Where overhead crossings are closely spaced, it is desirable to place signs on the bridges to enhance safety and economy. Butterfly-type signs, and other overhead sign supports shall not be erected in gores or other exposed locations in new signing projects.

2E-18 Urban Expressways

Urban expressways are characterized not so much by city limits or other boundary lines, but by factors such as high traffic volumes, lower operating speeds, closely-spaced interchanges, and roadway lighting.

Operating conditions and road geometrics on urban expressways usually require special sign treatment. This involves the following considerations:

1. Use of Interchange Sequence signs (sec. 2E-34).
2. Use of sign spreading to the maximum extent possible (sec. 2E-31).
3. Elimination of service signing (sec. 2E-37).
4. Reduction to a minimum of post interchange signs (sec. 2E-32).
5. Display of advance signs at distances closer to the interchange, with appropriate adjustment in the legend (sec. 2E-26).
6. Use of overhead signs on roadway structures and independent sign supports (sec. 2E-17).
7. Use of diagrammatic signs in advance of intersections and interchanges (sec. 2F-24).

2E-19 Expressway Guide Sign Classification

Expressway guide signs are classified and treated in the following categories:

1. Route markers and trailblazers (sec. 2E-20).
2. Intersection signs (sec. 2E-21).
3. Interchange signs (secs. 2E-24 to 2E-33).
4. Interchange sequence series signs (sec. 2E-34).
5. Community Interchanges Identification sign (sec. 2E-35).
6. Next (X) exits area signs (sec. 2E-36).
7. General Services signs (sec. 2E-37).
8. Rest area and scenic area signs (sec. 2E-38).
9. Recreational and cultural interest area signs (sec. 2E-39).
10. Milepost markers (sec. 2E-40).
11. Miscellaneous guide signs (sec. 2E-42).

2E-20 Route Markers and Trailblazers

Route markers on expressways ordinarily are incorporated as shields or other distinctive shapes in large directional guide signs. Independently mounted route markers may be used in lieu of Pull Thru signs as confirmation information (sec. 2E-32). These markers should be located just beyond the exit.

Route markers and auxiliary markers showing junctions and turns should be used for guidance on approach roads, for route confirmation just beyond entrances and exits, and for reassurance along the expressway. Where used along the expressway, the markers should be suitably enlarged. Dimensional data for route marker shields is given in the Standard Highway Signs booklet.*

The standard Trailblazer assembly (sec. 2D-33) has application on roads leading to the expressway. Component parts of the Trailblazer assembly may be included on a single sign panel.

2E-21 Signs for Intersections at Grade

Wherever there are intersections at grade within the limits of an expressway, sign types specified in Part II-D will be applicable. However, such signs should be of a size compatible with the level of other signing on the expressway. Advance guide signs for intersections at grade may take the form of diagrammatic layouts depicting the geometrics of the intersection along with essential directional information. Guidelines for design of diagrammatic signs are contained in sec. 2F-24.

2E-22 Uniform Signing by Type of Interchange

Signing should be consistent for each type of interchange to help motorists identify the geometric layout, as well as to obtain route, direction and destination information for specific exit ramps. Where unusual geometric features exist, sign modifications may be justified, but should be held to a minimum to preserve a pattern of uniformity and expectancy. Figures 2-27 through 2-42 (pages 2F-15 to 2F-33) show applications of guide signs for common types of interchanges.

2E-23 Expressway Interchange Classification

For expressway signing purposes interchanges are classed as major, intermediate and minor.

1. Major interchanges are subdivided into two categories:
    - (a) Interchanges with other expressways or freeways.
    - (b) Interchanges, other than those named in (a), with high-volume multilane highways, principal urban arterials, and major rural routes where the interchanging traffic is heavy or includes many drivers unfamiliar with the area.

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* Available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590

2. Intermediate interchanges are those with urban and rural routes not in the category of major or minor interchanges, as defined herein.

3. Minor interchanges include those where traffic is local and very light, such as the interchanges with land service access roads. Where the sum of exit volumes is estimated to be lower than 100 vehicles per day in the design year, the interchange is classed as minor.

2E-24 Interchange and Exit Numbering

The feasibility of numbering interchanges or exits on an expressway will depend largely on the extent to which grade separations are provided. Where there is appreciable continuity of interchange facilities, interrupted only by an occasional intersection at grade, the numbering will be helpful to the expressway traveler.

Where used, the interchange numbering systems shall conform to the provisions prescribed for freeways (sec. 2F-19). The exit number legend, if used, shall be white letters and numerals (table II-1) on a green background and shall appear on interchange guide signs as hereinafter described in sections 2E-25 through 2E-32 and as shown in figures 2-9, 2-13, and 2-14, (pages 2E-11, 2E-15 and 2E-16).

2E-25 Interchange Guide Signs

Interchange guide signs, in proper sequence, combine the functions of separate Route Marker and Destination signs, previously described in Part II-D, to give all necessary navigation information through interchanges. Guide signs placed in advance of an interchange deceleration lane should be spaced at least 800 feet apart. Sections 2E-26 through 2E-35 describe, in order, the signs that should appear at the approach to, at, and beyond each interchange.

When interchange sequence series signs (sec. 2E-34) are used it is preferable to use them over the entire length of a route in an urban area. They should not be used on a single interchange basis.

2E-26 Advance Guide Signs (fig. 2-9)

The advance guide sign gives notice well in advance of the exit point of the principal destinations served by the next interchange and the distance to that interchange. Where there is less than 800 feet between interchanges, interchange sequence series signs should be used in lieu of the advance guide sign for the affected interchanges. The minimum distance could be reduced, where necessary, to 650 feet because of lower operating speeds.

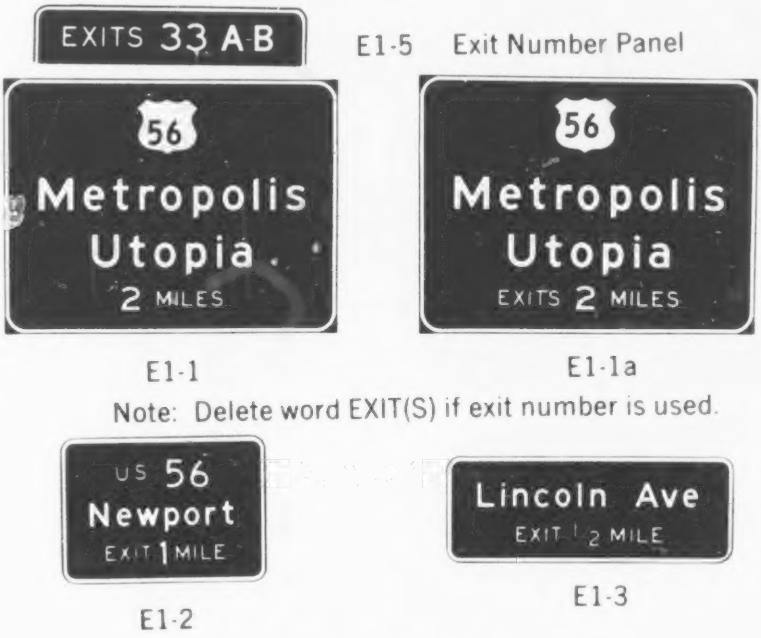
For major and intermediate interchanges, two and preferably three advance guide signs should be used. The recommended location for their placement is one-half, one and two miles in advance of the exit. However, where this is not practicable the distance shown should be to the nearest 1/4 mile. Fractions of a mile, rather than decimals, should be shown in all cases. The legend on the sign shall be the same as on the Exit Direction sign except that the last line shall read EXIT 1 MILE or EXIT 2 MILES as the case may be. If the interchange has two or more exit roadways, the bottom line shall read EXITS 1 (2) MILE(S). However, where interchange exit numbers are used, the word EXIT may be omitted from the bottom line. Where the distance between interchanges is more than 1 mile, but less than 2 miles, the first advance guide sign may be closer than 2 miles, but not placed so as to overlap the signing for the previous exit.

At minor interchanges, only one advance guide sign is required. It should be located ¼ to ½ mile from the exit gore.

Where advance guide signs are for a left exit, diagrammatic signs should be used. When used, they shall conform to section 2F-24.

Duplicate advance guide signs or interchange sequence series signs may be placed on the opposite side of the roadway and are not included in the minimum requirements of interchange signing.

Recommended letter and numeral sizes for advance guide signs are shown in table II-1 (page 2E-4).


EXITS 33 A-B
E1-5 Exit Number Panel
56
Metropolis
Utopia
2 MILES
56
Metropolis
Utopia
EXITS 2 MILES
E1-1
E1-1a
US 56
Newport
EXIT 1 MILE
Lincoln Ave
EXIT ½ MILE
E1-3
E1-2

Note: Delete word EXIT(S) if exit number is used.

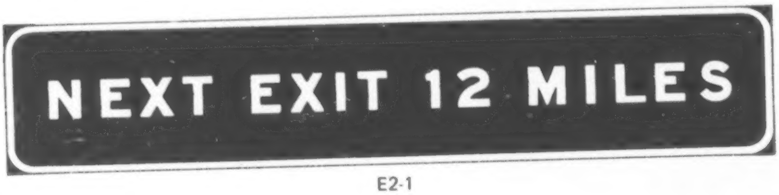
Figure 2-9. Typical interchange advance guide signs.

2E-27 Next Exit Supplemental Sign (fig. 2-10)

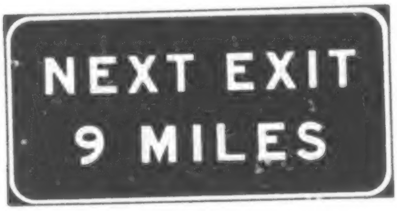
Where the distance to the next interchange is such that a driver failing to make a desired turn would be required to travel a number of miles out of his way, it may be desirable to use a supplementary panel mounted below the advance guide sign nearest the interchange. This will carry the legend NEXT EXIT (12) MILES. Where this sign is used, it shall be placed below the guide sign nearest the interchange. Normally, the Next Exit sign should not be used unless the distance between successive interchanges is more than 5 miles.

The legend for the Next Exit sign may be displayed in either one or two lines. The one-line message is the more desirable choice unless the message causes the sign to have a horizontal dimension greater than that of the advance guide sign.

When this sign is used and mounted below the advance guide sign, the breakaway feature shall not be adversely affected by the mounting. For example, a sign should be placed above the "hinge point" on one type of sign support. In any case, the sign(s) should be located above the yielding point of the support post.



E2-1



E2-1A

Figure 2-10. Next exit supplemental advance guide sign.

2E-28 Other Supplemental Signs (figs. 2-11, 12)

Information regarding destinations accessible from an interchange, other than places shown on the standard interchange signing, may be shown on a supplemental guide sign. Such a sign may list one or two destinations followed by the interchange number (and suffix) or if interchanges are not numbered, by the legend NEXT RIGHT or SECOND RIGHT or both, as appropriate. The supplemental guide sign installation should be erected approximately mid-way between the two major advance guide signs. If only one advance guide sign is used, the supplemental sign should follow by at least 800 feet.

Supplemental signing can reduce the effectiveness of other more important guide signing because of the possibility of overloading the vehicle operator's capacity to receive and make decisions on visual messages. States may develop an appropriate policy for such signing. Such items as population, traffic generated and distance from the expressway route and the significance of the destination should be taken into account.

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Rev. 4

Only one supplemental guide sign may be used on each interchange approach. If used, it is normally installed as an independent guide assembly.

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Rev. 4

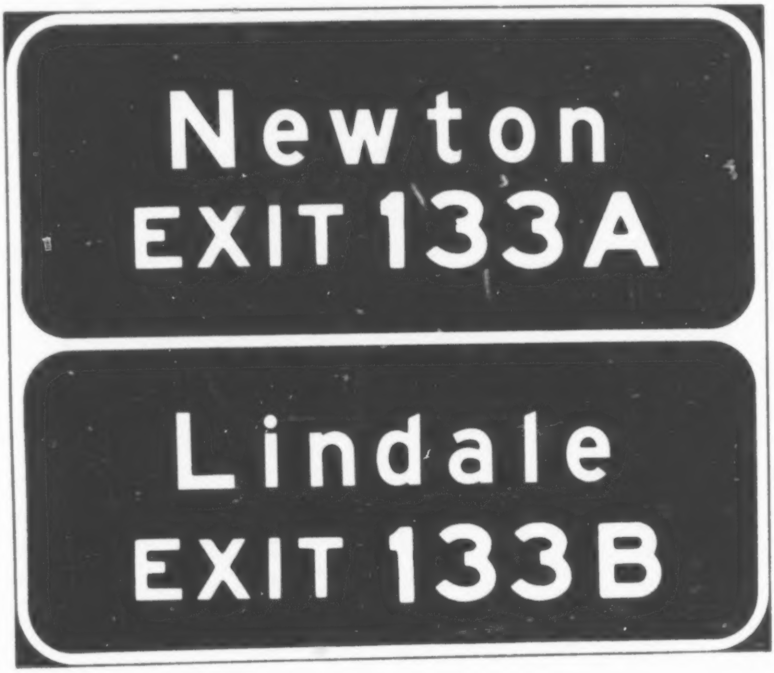

Figure 2-11. Other supplemental advance guide signs.

Guide signs directing motorists to park and ride facilities shall be considered as supplemental signs. Figure 2-12 shows a typical sign. If the interchanges are numbered, the interchange number should be used for the action message (fig. 2-26, sec. 2F-20). Section 2D-41 contains information on the use of local transit logos and the carpool symbol.

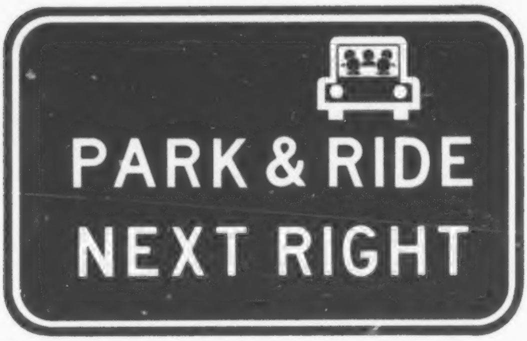

Figure 2-12. Guide sign to park & ride facility. (Expressway)

2E-29 Exit Direction Signs (fig. 2-13)

The exit direction sign repeats the route and destination information that was shown on the advance guide sign(s) for the next exit, and thereby assures the driver of the destination served and indicates whether he leaves on the right or on the left for that destination.

Exit direction signs are required at major and intermediate interchanges and should be used at minor interchanges. Such signs are usually ground mounted at the beginning of the deceleration lane. If there is less than 300 feet from beginning of deceleration lane to the theoretical gore (fig. 3-11, page 3B-15), the exit direction sign should be erected overhead over the exiting lane in the vinicity of the theoretical gore.

Other reasons to consider using overhead exit direction signs are contained in section 2A-22. Where a through lane is being terminated at an exit (a "lane drop") the exit direction sign shall be placed overhead at the theoretical gore.

In some cases, principally in urban areas, restricted sight distance due to structures or unusual alignment may make it impossible to locate the exit direction sign without violating the required minimum spacing between major guide signs. In such circumstances, interchange sequence series signs may be substituted for an advance guide sign, but shall not be substituted for the exit direction sign.

The following provisions govern the design and application of the overhead exit direction sign:

1. The sign shall carry the exit number (if used), the route number, cardinal direction and destination with an appropriate upward slanting arrow (figure 2-13).

2. At multi-exit interchanges the sign should be located directly over the exiting lane for the first exit. At the same location and normally over the right-hand through lane, an advance guide sign for the second exit should be located. Only for those conditions where the through movement is not evident should a confirmatory message (Pull Thru sign, fig. 2-15) be used over the left lane(s) to guide motorists travelling through an interchange. Pull Thru signs shall not otherwise be used. In the interest of sign spreading, three signs on one structure is not recommended.

3. Overhead exit direction signs may also be used effectively at the second exit. If the second exit is beyond an underpass, the sign should ordinarily be mounted on the face of the overhead structure. When the expressway is on an overpass, the exit direction sign should be on a cantilever support over the exit lane in advance of the gore point.

4. The message "EXIT ONLY" in black on a yellow panel shall be used on the overhead exit direction sign to advise drivers of a lane drop situation. The sign shall conform to the provisions of section 2F-25.

Diagrammatic signs shall not be employed at the exit direction location. Letter and numeral sizes are presented in table II-1 (page 2E-4) and arrow dimensions are presented in the appendix of the Standard Highway Signs booklet.*

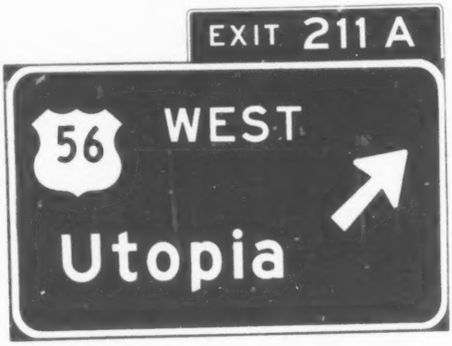

Figure 2-13. Interchange exit direction signs.

2E-30 Gore Signs (fig. 2-14)

The gore sign indicates the place of departure from the main-line roadway. Therefore, consistent application of this type of sign according to design conditions is of much importance. The basic need is for a sign to indicate the exiting point. Each gore should be treated similarly, whether the interchange has one exit roadway or multiple exits.

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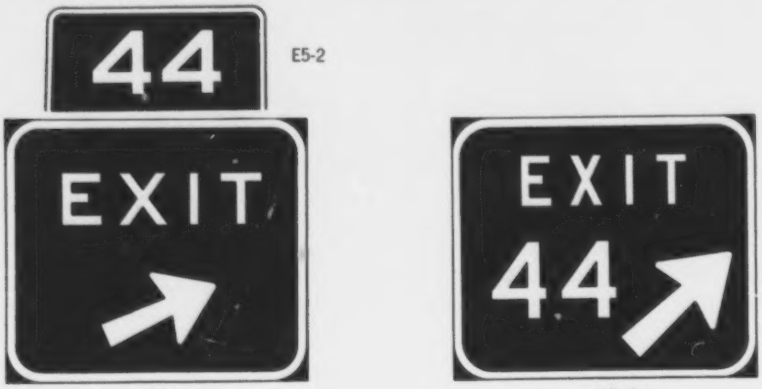
* Available from the Federal Highway Administration (HTO-20) Washington, D.C. 20590

The gore sign shall be located in the area between the main roadway and the ramp at all exits. The sign shall carry the word EXIT or EXIT with a number (if interchange numbering is used) and an appropriate upward slanting arrow. The arrow should be aligned to approximate the angle of departure. Breakaway or yielding supports shall be used where they are vulnerable to vehicles out of control.



E5-2

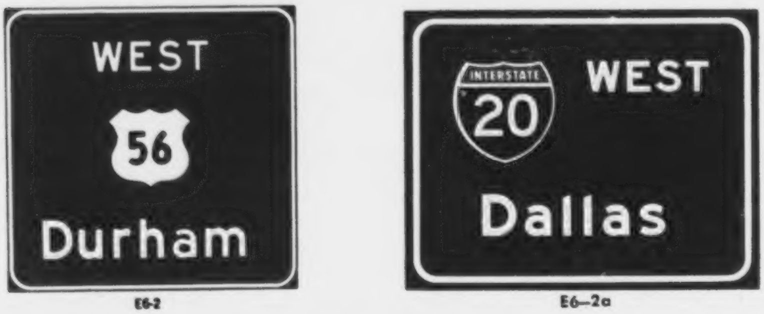
E5-1

E5-1a

Figure 2-14. Gore signs.

2E-31 Sign Spreading and Pull Thru Signs (figs. 2-15, 2-16)

Sign spreading is a concept where major overhead guide signs are so spaced that motorists are not overloaded with a group of signs at one location. Where overhead signing is used, sign spreading should be used at all single exit interchanges and to the extent possible at multi-exit interchanges.



E6-2

E6–2a

Figure 2-15. Pull-thru signs.

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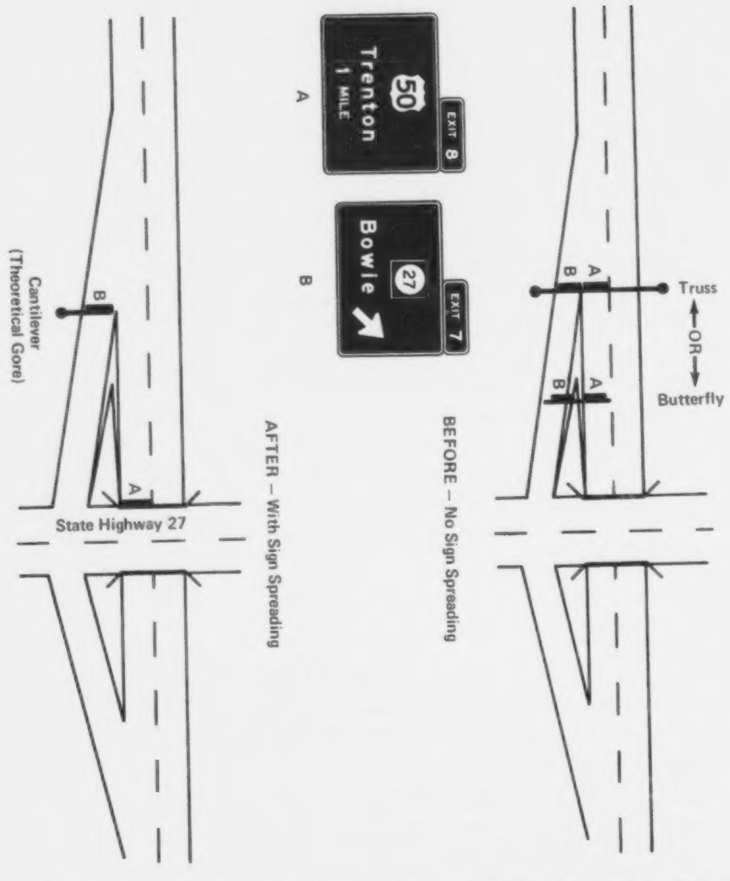

Truss
OR
Butterfly
A
B
A
B
BEFORE – No Sign Spreading
EXIT 8
50
Trenton
1 MILE
A
EXIT 7
27
Bowie
B
AFTER – With Sign Spreading
B
A
Cantilever
(Theoretical Gore)
State Highway 27

Figure 2-16. Spreading of guide sign information (Navigational information).

Sign spreading is accomplished as follows:

1. The exit direction sign is the only sign used in the vicinity of the gore. It is located overhead near the theoretical gore and generally on a cantilever.
2. The advance guide sign for the next interchange exit should be placed on the interchange overcrossing structure when the crossroad goes over. If the mainline goes over the crossroad the sign should be placed on a cantilever or it may be ground mounted, and should be located behind the guardrail leading to the bridge rail.
3. Pull Thru signs are eliminated when sign spreading is applied. (See fig. 2-16 for sign spreading.) Pull Thru signs should be used only when the geometrics of a given interchange are such that it is not clear to the driver as to which is the through roadway. Pull Thru signs with down arrows, as illustrated in figure 2-27, (page 2F-15) should be used when the alignment and number of through lanes is not readily evident.

2E-32 Post-Interchange Signs

Where space between interchanges permits, as in rural areas and where undue repetition of messages will not occur, a fixed sequence of signs should be displayed beginning 500 feet beyond the end of the acceleration lane. At this point there should be a route marker assembly, followed 1,000 feet farther along by a speed limit sign, and this followed in another 1,000 feet by a distance sign.

Where space between interchanges does not permit placement of these three post-interchange signs without encroaching on or overlapping the advance guide signs necessary for the next interchange, or in rural areas where the interchanging traffic is primarily local, one or more of the post-interchange signs should be omitted. Usually the distance sign will be of less importance than the other two signs and can, therefore, be omitted especially where interchange sequence signs are used. If the sign for through traffic on an overhead assembly already contains the route marker, the post-interchange route marker assembly may also be omitted.

2E-33 Distance Signs (fig. 2-17)

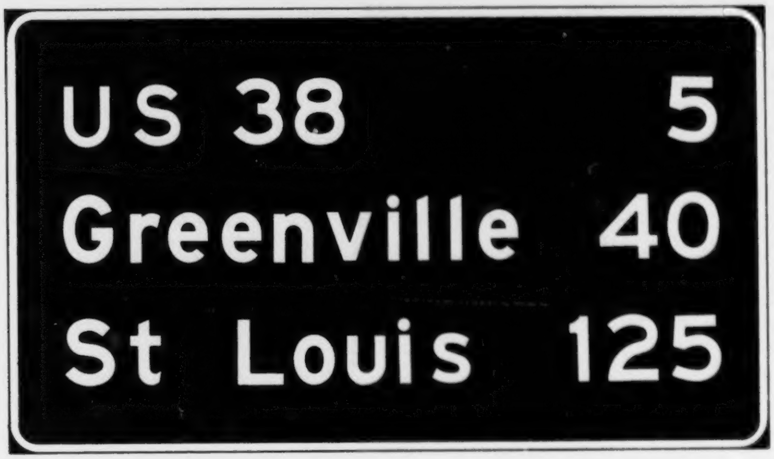
Where used, the post-interchange distance sign shall consist of a two- or three-line sign carrying the names of significant destination points and the distances to those points. Destination points should be selected and arranged as follows:

1. The top line of the sign shall identify the next meaningful interchange with the name of the community near or through which the expressway route passes, or if there is no community, the route number or name of the intersected highway.

2. A second line may be used on the sign, and when used, should be reserved for communities of general interest which are on or immediately adjacent to the route or major traffic generators that the route was specifically located to serve. The choice of names for the second line, when it is used, can be varied on successive distance signs to give motorists maximum information concerning communities served by the expressway.

3. The third, or bottom line, shall contain the name and distance to a control city (if any) which has national significance for travelers using the expressway route.

Under normal conditions, distances to the same destinations should not be shown more frequently than at five-mile intervals. The distances displayed on these signs should be the actual distance to the destination points and not to the exit from the expressway.



E7

Figure 2-17. Post interchange distance sign.

2E-34 Interchange Sequence Series Signs (fig. 2-18)

Where interchanges are so closely spaced, particularly through large urban areas, that major guide signs cannot be adequately spaced, interchange sequence series signs identifying the next two or three interchanges may be used. Interchange sequence series signs are generally supplemental to advance guide signs. However, where there is less than 800 feet between interchanges, such signs should be used in lieu of the advance guide signs for the affected interchanges. Interchange sequence series signs shall not be substituted for exit direction signs.

When such signs are used, it is preferable to use them over the entire length of a route in an urban area. They should not be used on a single interchange basis. Signing of this type is illustrated in figures 2-18 and 2-41, (page 2F-32) and is compatible with the sign spreading concept.

These signs display the next two or three interchanges by name or route number with distances to the nearest ¼ mile. Interchange numbers may be shown to the left of the interchange name or route number. When used, the first sign in the series shall be located in advance of the first advance guide sign for the first interchange. Thereafter, the signs should be placed approximately midway between interchanges. The signs shall be mounted at overhead height preferably in the median.

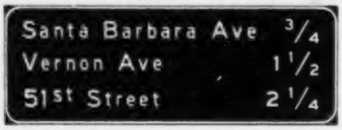


Figure 2-18. E8-1

Where appropriate, interchange names or route numbers shown on such signs may be followed by the legend LEFT or LEFT EXIT in black letters on a yellow rectangular background where the exit direction is to the left. Separate panels may be attached to the sign panels for this purpose. II-38 (c) Rev. 3

2E-35 Community Interchanges Identification Sign (E8-2, fig. 2-19)

For suburban or rural communities served by two or three interchanges, community interchange identification signs are useful. In these cases the name of the community followed by the word "Exits" should be shown on the top line; the destination, state (road) name or route number, and the corresponding distances to the nearest ¼ mile should be shown below.

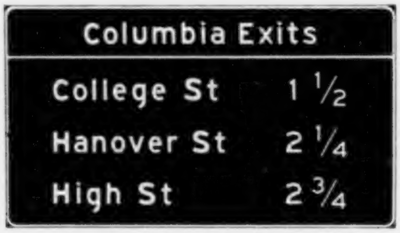
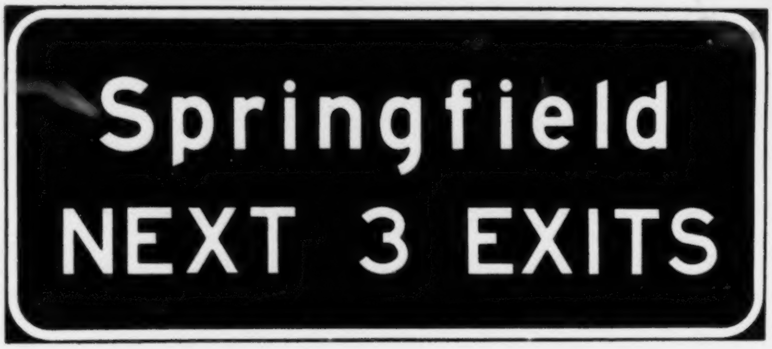


Figure 2-19. E8-2

The sign should be located in advance of the first advance guide sign for the first interchange within the community. If interchanges are not conveniently identifiable or if there are more than three interchanges as to be identified, the Next (X) Exits Area sign (E9) may be used.

2E-36 Next (X) Exits Area Sign (fig. 2-20)

Expressways may pass through " historical" or "recreational" regions, or urban areas served by a succession of several interchanges. Such regions or areas may be indicated by a special sign located in advance of the advance guide sign or signs for the first interchange. The sign legend should identify the region or area followed by the words NEXT (X) EXITS.



E9

Figure 2-20. Next (x) exits area sign.

2E-37 Signing for General Motorist Services (fig. 2-21)

On rural sections of expressways where general motorist services are infrequent, service signing may be needed. In such cases, the provisions of section 2D-46 will apply, except that signs should be suitably enlarged. Letter and numeral sizes are shown in table II-1 (page 2E-4). Approved symbols may be used as an alternate to word messages whenever motorist service signs are used but intermixing of symbols and word legends shall not be permitted.

The interchange exit number may be displayed atop the main panel (see fig. 2-43, page 2F-35). The action message line may then show the distance to the exit.

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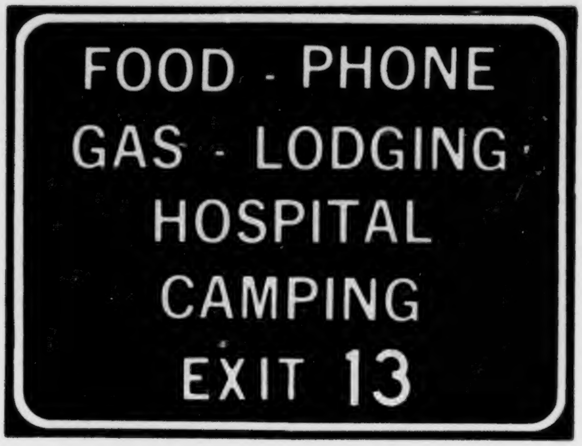

Figure 2-21. Signing for General Motorist Services.

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Rev. 4

2E-38 Rest and Scenic Areas

Signing for safety rest areas and for scenic areas should conform to the provisions previously set forth in sections 2D-42 and 2D-43. However, the signs should be suitably enlarged for expressway application. To provide the motorist with information on the location of succeeding rest areas a sign with the word message NEXT REST AREA XX MILES may be installed independently or as a supplemental panel mounted below one of the advance rest area guide signs. The sign or panel shall have reflectorized white letters and border on a blue background. Letter and numeral sizes are shown in Table II-1 (page 2E-4).

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Rev. 2

2E-39 Recreational and Cultural Interest Area Signs

Recreational and cultural interest area signs of the type described previously in section 2D-44 may have application on expressway facilities. Where such signs are used, the provisions of the section should be followed with suitable enlargement of the signs for expressway conditions.

2E-40 Milepost Markers

Milepost markers will be required on expressway facilities which are located on a route where there is milepost continuity. In such cases, the provisions of section 2F-39 will apply.

2E-41 Wrong-Way Traffic Control (figs. 2-22a and 2-22b)

To help prevent wrong-way usage, efforts shall be made to identify and correct highway ramp terminals.

On interchange exit ramps where the ramp intersects a crossroad in such a manner that wrong-way entry could be made:

1. ONE-WAY signs shall be placed where the exit ramp intersects the crossroad. Turn prohibition signs may be placed, especially on two-lane rural crossroads, appropriately in advance of the ramp intersection to supplement the ONE-WAY sign.
2. DO NOT ENTER signs shall be conspicuously placed near the end of the exit ramp in positions appropriate for full view of a driver starting to enter wrongly.
3. At least one WRONG-WAY sign shall be placed on the exit ramp. Additional WRONG-WAY signs may be used where the ramp geometrics justify their installations.
4. On two-lane paved crossroads at interchanges, double solid yellow lines should be used as a centerline for an adequate distance on both sides approaching the ramp intersections.
5. In each lane at an exit ramp, one or more pavement marking arrows should be placed near the crossroad terminal to supplement wrong way signing at locations where wrong way usage occurs or there is the likelihood of wrong way movement. These markings, which should be clearly in sight of a wrong way driver, may consist of traffic paint, thermoplastic material, bidirectional red and white raised pavement markers, or other units that show red to wrong way drivers and white to other drivers. III-16 (c)
6. Symbol arrow pavement markings may be placed on the crossroad at appropriate locations near the ramp junction to indicate the permissive direction of flow.
7. Guide signs may be used on entrance ramps near the crossroad to inform drivers of the correct "Freeway Entrance."

On interchange entrance ramps where the ramp merges with the through roadway:

1. Where the design of an interchange does not clearly make evident the direction of traffic on the separate roadways or ramps, a ONE-WAY sign visible to traffic on the entrance ramp and through roadway should be placed on each side of the through roadway opposite to the entrance ramp. A No Left Turn sign also may be placed along the right-hand side of the ramp just in advance of the entrance ramp terminal.
2. Arrow pavement markings may be placed at appropriate locations on the entrance ramp and major road through lanes to indicate the permissive direction of traffic flow.

At locations which are determined to have a special need, other standard warning or prohibitive methods and devices may be used as a deterrent to the wrong-way movement.

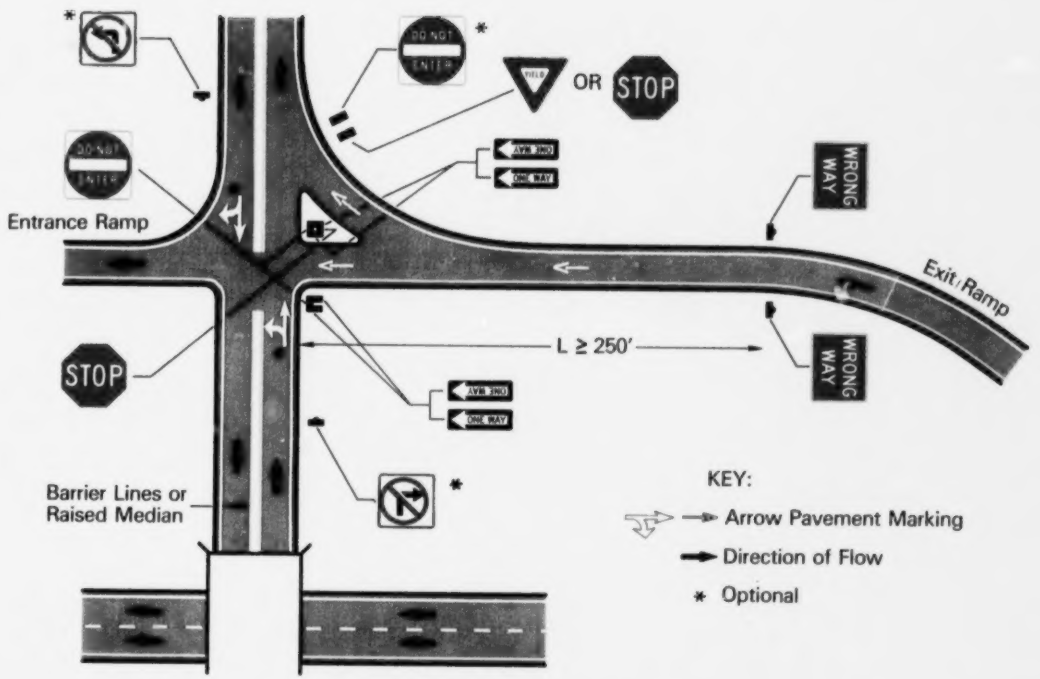
DO NOT ENTER
*
OR
STOP
ONE WAY
ONE WAY
WRONG WAY
*
DO NOT ENTER
Entrance Ramp
Exit Ramp
STOP
L ≥ 250'
ONE WAY
ONE WAY
WRONG WAY
Barrier Lines or Raised Median
*
KEY:
Arrow Pavement Marking
Direction of Flow
* Optional

Figure 2-22a. **Regulatory signing, delineation and arrow markings at exit ramp terminals to deter wrong-way entry (Modify as appropriate for 4-lane crossroads)**

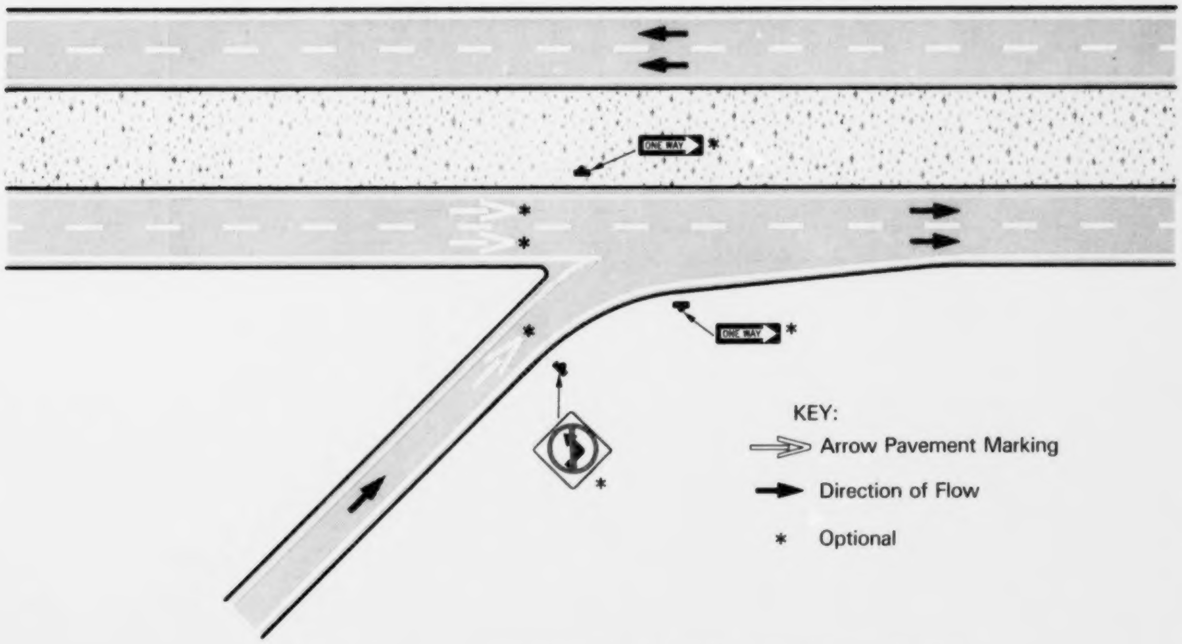
ONE WAY
*
ONE WAY
*
*
*
*
*
KEY:
Arrow Pavement Marking
Direction of Flow
* Optional

Figure 2-22b. **Regulatory signing and arrow markings at entrance ramp terminals where design does not clearly indicate the direction of flow**

2E-42 Miscellaneous Guide Signs

Miscellaneous guide signs, such as those pointing out geographical features like rivers, summits, and political boundaries (sec. 2D-49) may be used on expressways if they do not interfere with signing for interchanges or other critical points. If they are to be of value to the expressway traveler they should be consistent with other expressway signs in design and legibility.

2E-43 Weigh Station Signing

Where Weigh Station signing is applicable on an expressway route the provisions of section 2D-45 should be followed except that the distance to the exit direction sign should be 1500 feet minimum. Sign sizes and legend for expressways are contained in the Standard Highway Signs booklet.*

2E-44 Special Signing on Expressway Approaches and Connecting Roadways

The identification of entrances to expressways from roads of lesser importance should be given adequate attention. Conventional signing on the approach roads, as prescribed in Part II-D, may in some cases be ineffective for some of the more critical interchanges. Under such conditions the expressway signing standards may have to be extended to the approach roads.

Signing for frontage roads need not be to the same standard as is used on the through traffic roadways of the expressway, but otherwise should be consistent with requirements for roadways of this class. Good judgment and careful attention to details of such signs and their locations must be exercised in the vicinity of ramp terminals to avoid giving drivers confusing or conflicting information, or creating sight obstructions.

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* Available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590

F. GUIDE SIGNS—FREEWAYS

Section 2F-1 Scope of Freeway Sign Standards

Standards for guide signs prescribed herein shall apply to any freeway. These standards, with the exception of certain markers reserved exclusively for the Interstate Highway System provide a uniform and effective system of highway signing that will be fully adequate for high-volume, high-speed motor vehicle traffic on all modern freeways.

Toll road authorities are required to comply with the standards defined herein.

Where appropriate, to reduce redundancy, reference is made to other applicable sections of Part II for selected standards for freeway signing.

2F-2 Freeway Signing Principles

The development of a signing system for freeways must be approached on the premise that the signing is primarily for the benefit and direction of drivers who are not familiar with the route or area. The signing must furnish drivers with clear instructions for orderly progress to their destinations.

Sign installations are an integral part of the freeway facility and, as such, must be planned concurrently with the development of highway location and geometric design. Plans for signing must be analyzed during the earliest stages of preliminary design and details correlated as final design is developed.

Interstate routes are not to be signed as memorial highways. This provision does not prohibit the erection and maintenance of memorial plaques indicating the highway is, for instance, a Blue Star Memorial Highway, if such plaques are placed in rest and recreational areas within or adjacent to the right-of-way of Interstate highways which have been designated as a memorial highway by State law or by official administrative action by the State highway department.

The naming of a bridge or highway on the Interstate System to recognize an individual or group of individuals is not to be recognized as a part of the official signing of the Interstate Highway System.

Under no conditions shall an Interstate route, that is officially designated as a memorial highway by State legislative or State highway administrative action, have signs erected along the route carrying the memorial name of the highway.

Except where they interfere with signing for interchanges or other equally critical points, miscellaneous guide signs of various types may be used to show State, county and other significant local jurisdictional boundaries. Signs of this character should not be installed unless there are specific reasons for orienting the users of the freeway or identifying control points for activities that are clearly to the public interest.

On all such signs the design should be simple and dignified, devoid of any tendency toward flamboyant advertising and in general conformance with other freeway signing.

2F-3 General Characteristics of Freeway Signing

Freeway signing should always be considered and developed as a planned system of installations. Engineering study will be necessary for proper solution of the problems of many individual locations, but, in addition, consideration of an entire route is necessary. The excessive signing found on many major highways usually is the result of using a multitude of signs too small and poorly designed and placed to accomplish the purpose intended.

Drivers should be confronted with consistent signing on the approaches to interchanges, as they drive from one State to another, and when driving through rural or urban areas. Geographical, geometric, and operating factors regularly create significant differences between urban and rural freeway conditions, and the signing must take these into account.

The standards prescribed for sign letter size on freeways are the same for both urban and rural areas. Space is often at a premium on urban sections, but the typical traffic pattern is also more complex for the driver to negotiate, and large easy-to-read copy is, therefore, just as necessary as on rural highways. The lower speeds characteristic of urban operation may well support consideration of different highway geometrics in design, but do not justify different sign standards.

2F-4 Characteristics of Urban Freeway Signing

The distinctive characteristics of freeway interchange signing for urban conditions are outlined in section 2E-18.

Urban conditions are characterized not so much by city limits or other arbitrary boundaries but by the following features:

1. Mainline roadways with more than 2 lanes.
2. High traffic volumes on the through roadways.
3. High volumes of traffic entering and leaving interchanges.
4. Interchanges closely spaced.
5. Roadway and interchange lighting.
6. Three or more interchanges serving the major city.
7. A loop, circumferential or spur serving a sizable portion of the urban population.

2F-5 Characteristics of Rural Freeway Signing

Rural areas ordinarily have greater distances between interchanges which permits adequate spacing for the sequences of signs on the approach to and departure from each interchange. The tendency to group all signing in the immediate vicinity of rural interchanges should be avoided by considering the entire route in the evolution of sign plans. Extra effort should be given to the placement of signs at natural target locations to command the attention of the driver, particularly when the message to be conveyed has a high relative priority.

Rural sections of freeways are subjected to high speed traffic. The absence of traffic in adjoining lanes and on entering or leaving ramps, often adds monotony to rural driving. This increases the importance of signs and markings that call for decision or action. Accordingly, where there are long distances between interchanges and the alignment is relatively unchanging, signs should be positioned for their best effect on drivers.

2F-6 Sign Layouts

There should be general adherence to the prescribed horizontal and vertical sequences for route markers, cardinal directions, destination names, arrows and other components of the sign display. The present standards are intended to result in nationwide uniformity and yet contain provisions flexible enough for most signing problems. Minor departures may be necessary when symbols are employed.

2F-7 Designation of Destinations

Freeways offer superior traffic service to population centers located on or near them. For this reason, the course of the freeway route and the major destinations or "control cities" (sec. 2D-37) along it must always be clearly identified. Destination legends should provide the drivers the best orientation possible. Continuity in successive sign messages and consistency with available map information are essential.

National guidelines for the selection of control cities are available. The "List of Control Cities For Use in Guide Signs on Interstate Highways" is available from the American Association of State Highway and Transportation Officials (for address see page iii). The determination of major destinations or control cities will be important to the quality of service provided by the freeway, and control city legends should be used in the following situations: II-77(c) Rev. 4

1. Interchanges between freeways.
2. Separation points of overlapping freeways.

3. On directional signs on intersecting routes, to guide traffic entering the freeway.

4. On Pull Thru signs.

5. On the bottom line of post interchange distance signs.

2F-8 Limit on Destination Legends

Destination names and directional information must not exceed the amount of copy that most drivers will be able to comprehend readily. The limitations on destination legends described in section 2E-9 shall apply to major guide signs on freeways. Population figures or other similar information shall not be used on exit guide signs.

2F-9 Routing to a Given Destination

A route diverging from a freeway should not be posted with any of the same destination names as are shown at that point for the freeway route. At any decision point, a given destination shall be indicated over only one route.

2F-10 Overhead Sign Installations

Overhead signs have application in lieu of or as an adjunct to ground signs when engineering study indicates that they are needed. Factors which may justify the erection of overhead signs are enumerated in section 2A-22. These factors should be evaluated to arrive at decisions to erect overhead signs.

Information relative to the design of sign structures has been standardized by the American Association of State Highway and Transportation Officials.*

Use of overcrossing structures for the support of overhead signs is described in section 2E-17.

2F-11 Style of Lettering and Legend Spacing

Letter style and height, and arrow design have been standardized for freeway signs to assure uniform and effective application. With all freeway signs, the message dimensions shall be determined first, and the outside sign dimensions secondarily. The prescribed numeral and letter sizes according to interchange classification and component of sign legend appear in table II-2. Other sign letter size requirements not specifically identified elsewhere in this Manual should be guided by these specifications.

All names of places, streets, and highways on freeway guide signs shall be composed of lower-case letters with initial upper-case letters. The initial upper-case letters shall be about 1⅓ times the "loop" height of the lower-case letters. Other word legends shall be in upper-case letters. Designs for upper-case and lower-case alphabets are available, together with tables of recommended letter spacing, from the Federal Highway Administration.** The initial letters and the numerals used will be Series E(M) of the Standard Alphabets for Highway Signs.

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*Available from the American Association of State Highway and Transportation Officials, Washington, D.C. 20004.

Interline and edge spacing shall be as specified in section 2E-12.

Abbreviations may be used but should be kept to a minimum. The provisions of sections 2A-14 and 2E-12 shall apply.

Table II-2 Letter and Numeral Sizes for Freeway Guide Signs

A. ***Advance Guide, Exit Direction, and Overhead Signs***

	*Major**				
	*Category (a)**	*Category (b)**	*Intermediate**	*Minor**	*Overhead*
Exit Panel					
Word	10"	10"	10"	10"	10"
Numeral	15"	15"	15"	15"	15"
Letter	15"	15"	15"	15"	15"
Interstate Route Marker					
Numeral	24" | 18"				18"
Shield					
(1-2 Digit)	48 x 48 | 36 x 36				36" x 36"
(3 Digit)	60 x 48 | 45 x 36				45" x 36"
U.S. or State Marker					
Numeral	24" x 18"	18"	18"	12"	18"
Shield					
(1-2 Digit)	48 x 48 | 36 x 36	36" x 36"	36" x 36"	24" x 24"	36" x 36"
(3 Digit)	60 x 48 | 45 x 36	45" x 36"	45" x 36"	30" x 24"	45" x 36"
or Alternate (Ex: U.S. 56)					
Initials	15"	15" | 12"	12"	10"	12"
Numeral	18"	18" | 15"	15"	12"	15"
Cardinal Direction					
Word	15"	15" | 12"	12"	8"	12"
Name of Place, Street, or Highway					
Word	20"/15"	20"/15"	16"/12"	13.3"/10"	16"/12"
Distance					
Numeral	18"	18" | 15"	15"	12"	15"
Fraction	12"	12" | 10"	10"	8"	10"
Word	12"	12" | 10"	10"	8"	10"

* See Section 2E-23 Interchange Classification.

Note: (|) Vertical bar signifies separation of desirable and minimum sizes.

(/) Slanted bar signifies separation of upper-case and lower-case alphabets.

B. ***Gore Signs***

At major and intermediate interchanges	
Word	12"
Numeral & Letter	18"
At minor interchanges	
Word	8"
Numeral & Letter	10"

** Available from the Federal Highway Administration (HTO-20) Washington D.C. 20590.

TABLE II-2 Letter and Numeral Sizes for Freeway Guide Signs—Cont.

C. *Pull Thru Signs*	
Destination Message	
Word	16"/12"
Route Marker as Message	
Cardinal Direction	12"
Route Marker	36"×36"
D. *Supplemental Guide Signs*	
Exit Number	
Word	10"
Numeral	15"
Letter	15"
Place name	13.3"/10"
Action message	10"
E. *Variable Message Signs***	
Place name	13.3"/10"
Advisory message	13.3"/10"
Action message	
Word	10"
Numeral	10"
Warning & Regulatory	see Standard Highway Signs booklet for sizes.***
F. *Interchange Sequence Signs*	
Word	13.3"/10"
Distance Numeral	13.3"
Fraction	10"
G. *"Next—Exits" Signs*	
Place name	13.3"/10"
NEXT—EXITS	10"
H. *Distance Signs*	
Word	8"/6"
Numeral	8"
I. *General Motorist Services Signs*	
Exit Number	
Word	10"
Number	15"
Letter	15"
Services	10"
J. *Rest Area and Scenic Area Signs*	
Word	12"
Distance	
Numeral	15"
Fraction	10"
Word	12"

**Variable message signs may often require larger legends or the use of all capital letters. The sizes shown here are minimum and larger sizes may be used depending on needs.

***Available from the Federal Highway Administration (HT0-20) Washington, D.C. 20590

Table II-2 Letter and Numeral Sizes for Freeway Guide Signs—Continued

Action Message	
Word	12"
K. *Mileposts*	
Word	4"
Numeral	10"
L. *Boundary and Orientation Signs*	
Word	8"/6"
M. *"Next Exit" and "Next Services" Signs*	
Word	8"
Numeral	8"
N. *"Exit Only"*	
Word	12"
O. *Diagrammatic Signs*	
Lane width	5"
Lane lines	1" x 6"
Vertical space between lane lines	6"
Stem height (up to the upper point of departure)	30"
Arrowhead—(standard "up" arrow)	
Space between arrowhead and route shield	12"

2F-12 Sign Borders

Signs shall have a border of the same color as the legend, to outline their distinctive shape and thereby give them easy recognition and a finished appearance. For guide signs larger than approximately 10 feet by 6 feet, the border should have a width of approximately 2 inches. For smaller guide signs, a width of approximately 1¼ inches may be used, but the width should not generally exceed the stroke width of the major lettering on the sign.

Corner radii of sign borders should be approximately one-eighth of the minimum dimension on guide signs, except that the radii should not exceed 12 inches on any sign. The sign area outside the corner radius need not be trimmed.

2F-13 Color, Reflectorization, and Illumination

Color, reflectorization and illumination of freeway guide signs shall conform to the provisions for expressway guide signs set forth in sections 2E-5 and 2E-6. In addition, the background of all overhead signs that are not independently illuminated shall be reflectorized. When a sign is internally illuminated the requirements for reflectivity do not apply.

Technological developments have produced a variety of types of illumination for highway signs. Internally illuminated signs, having translucent faces, are especially effective for freeway use. Their use may be justified for some installations. Where internal illumination is used, the sign colors shall appear essentially the same by night and by day.

2F-14 Sign Arrows

The design and application of arrows for freeway guide signs shall be the same as that specified in section 2E-15 for expressway signs. Dimensional details for "Up" and "Down" arrows are shown in the appendix of the Standard Highway Signs booklet.*

2F-15 Viewing Factors

The requirements set forth in section 2E-16 concerning placement of signs for effective viewing shall apply to freeway signing.

2F-16 Vertical Clearance

In ground installations, directional guide signs shall, except as noted below, be erected at a minimum height of 7 feet above the edge of the pavement to the bottom of the sign. If a sign is mounted below another sign, the major sign shall be at least 8 feet and secondary sign at least 5 feet above the level of the pavement edge.

When signs are positioned a significant distance away from the pavement edge to increase roadside safety, the vertical clearance on such signs may be reduced to 5 feet above the pavement edge. Notwithstanding the above, all regulatory and warning signs and route markers shall be at least 6 feet above the level of the pavement edge.

Overhead signs shall have a vertical clearance of not less than 17 feet to the sign, light fixture, or sign bridge, over the entire width of the pavement and shoulders, except that where a lesser vertical clearance is used for design of other structures the vertical clearance to overhead signs, light fixtures, or sign bridges need not be greater than one foot in excess of the clearance at other structures. In special cases it may be necessary to reduce the vertifical clearance still further because of substandard dimensions in tunnels and other major structures such as double-deck bridges.

2F-17 Horizontal Clearance

To provide a roadside recovery area for out-of-control vehicles, liberal horizontal clearances should be provided for roadside signs and overhead sign supports. No specific minimum clearance is established, but in no case shall any part of the sign or sign structure, which is within the applicable vertical clearance dimension and which is exposed to traffic, be less than 2 feet beyond any surface prepared for normal or emergency travel of vehicles.

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*Available from the Federal Highway Administration (HTO-20) Washington, D.C. 20590

Rigid criteria for lateral clearances should not be followed, but advantage should be taken of the longitudinal location of existing guardrail, overcrossing structures and similar conditions to lessen the exposure to traffic of signs and sign supports. Breakaway or yielding supports should be located as far from the traveled portion of the roadway as feasible.

Light standards may be used in place of separate sign supports to accommodate the installation of smaller signs and route markers wherever this is practicable.

2F-18 Interchange Classification

For freeway signing purposes, interchanges are classed as major, intermediate, or minor. These terms are defined in section 2E-23.

2F-19 Interchange Exit Numbering (figs. 2-23 through 2-25)

Interchange exit numbering along freeways provide valuable orientation for the driver and shall be used in signing each interchange exit. The general plan for numbering interchange exits is shown in figures 2-23 through 2-25.

Interchange exit numbers shall be displayed with each advance guide sign, the exit direction sign, and the gore sign. They may be used with supplemental guide signs and service signs. The exit number is to be displayed on a separate panel at the top of the major sign. Details of typical panel designs are shown in figures 2-9 and 2-14 (pages 2E-11 and 2E-16) and, as incorporated on guide signs, in figures 2-16 through 2-42.

Subject to the exceptions noted herein, the standard exit number legend shall include the word EXIT in 10-inch capital letters. The appropriate number shall be in 15-inch numerals and the suffix letter A or B (on multi-exit interchanges) in 15-inch capital letters in a single-line format on a panel 24 inches in vertical dimension.

Where a route originates within a State, the southernmost or westernmost terminus shall be the beginning point for numbering. If a loop, spur, or circumferential route crosses State boundaries, the sequence of numbering shall be coordinated by the States to provide continuous numbering.

For circumferential freeway routes, the numbering of interchanges shall be in a clockwise direction. The numbering shall begin with the first interchange west of an imaginary north-south line bisecting the circumferential route at a radial freeway or other Interstate route, or some other conspicuous landmark in the circumferential route near a south polar location. (See figure 2-23).

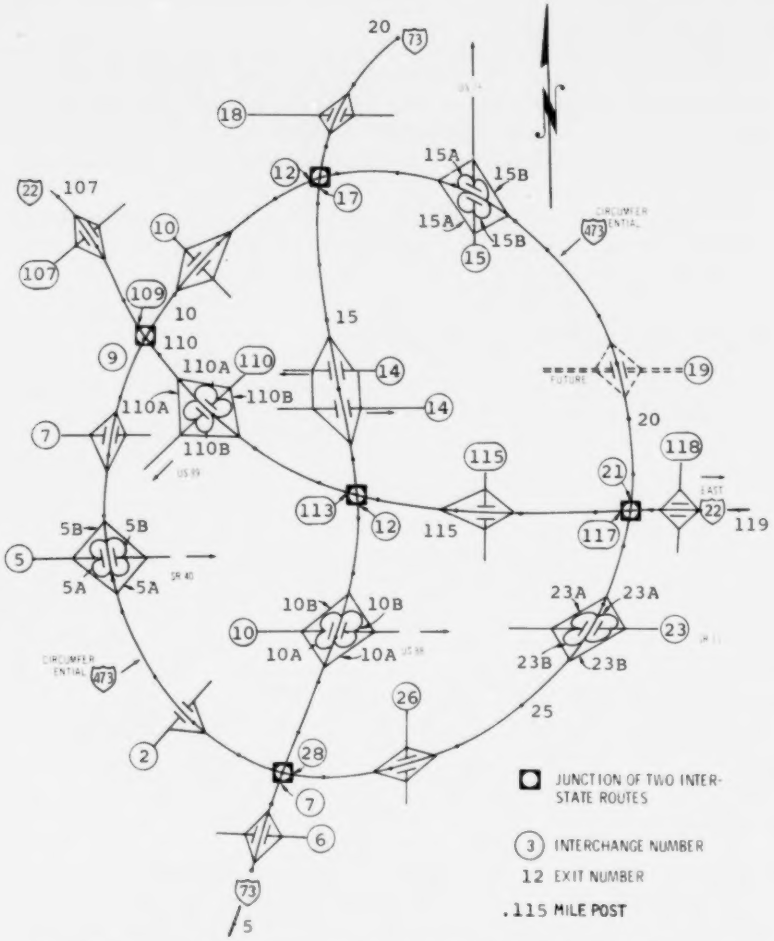

20
73
18
15A
15B
15A
15B
15
12
17
22
107
107
10
473
CIRCUMFERENTIAL
109
10
15
110
9
110A
110
14
19
FUTURE
110A
110B
14
7
110B
20
US 19
115
118
21
EAST
113
12
115
22
119
117
5B
5B
5
5A
5A
SR 40
10B
10B
23A
23A
10
10A
10A
23
23B
23B
CIRCUMFERENTIAL
473
26
25
2
28
7
6
73
5
JUNCTION OF TWO INTERSTATE ROUTES
3 INTERCHANGE NUMBER
12 EXIT NUMBER
.115 MILE POST

Figure 2-23. Typical interchange numbering for mainline and circumferential routes.

The interchange numbers on loop freeway routes shall begin at the loop interchange nearest the south or west main line junction and increase in magnitude toward the north or east main line junction. Spur route interchanges shall be numbered in ascending order starting at the interchange where the spur leaves the main line of the principal freeway route. (See figure 2-24).

Where numbered freeway routes overlap, continuity of interchange numbering shall be established for only one of the routes. Either route may be selected, but the one chosen should also have continuity in mileposting. (See figure 2-25.)

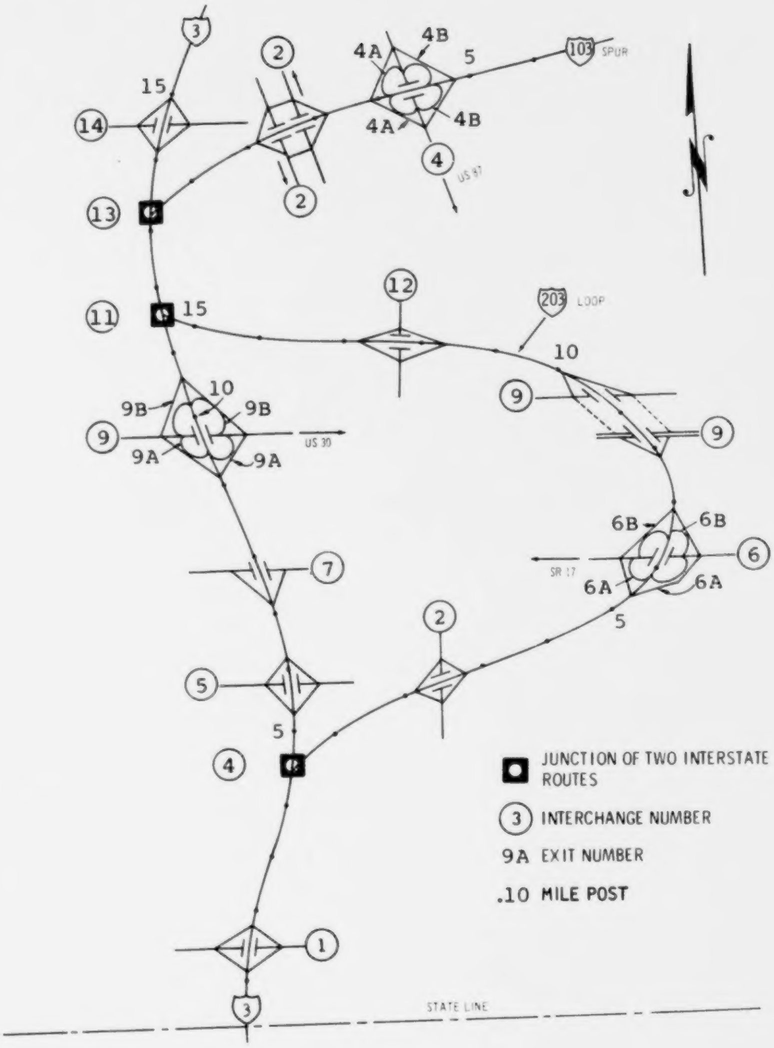

3
15
14
2
4A
4B
5
103 SPUR
4A
4B
4
US 97
2
13
11
15
12
203 LOOP
10
9
9
10
9B
9B
9
9A
9A
US 30
6B
6B
SR 17
6
6A
6A
7
2
5
5
5
4
1
3
STATE LINE
JUNCTION OF TWO INTERSTATE ROUTES
3 INTERCHANGE NUMBER
9A EXIT NUMBER
.10 MILE POST

Figure 2-24. Typical interchange numbering for mainline loop and spur routes.

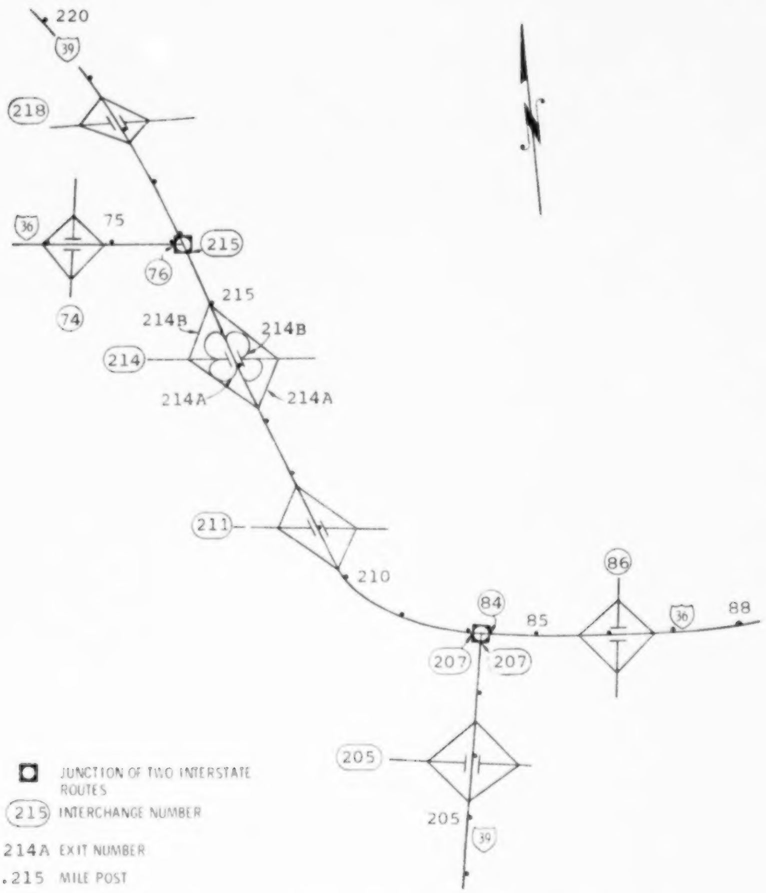

220
39
218
36
75
215
76
74
215
214B
214B
214
214A
214A
211
210
84
85
86
36
88
207
207
205
205
39
JUNCTION OF TWO INTERSTATE ROUTES
215 INTERCHANGE NUMBER
214A EXIT NUMBER
.215 MILE POST

Figure 2-25. Typical interchange numbering where freeway routes overlap.

2F-20 Interchange Guide Signs

As in the case of expressways with grade separations, the major signs at freeway interchanges and on their approaches are advance guide signs and exit direction signs. It is essential that the same destination messages be displayed on these signs. New destination information should not be introduced into the major sign sequence for one interchange, nor should information be dropped.

Reference should be made to sections 2E-25 through 2E-35 for a detailed description of the signs, in the order that they should appear at the approach to and at each interchange. Supplemental guide signing should be used sparingly as provided in section 2E-28. Guide signs directing motorists to park and ride facilities shall be considered as supplemental signs (fig. 2-26). Section 2D-41 contains information on the use of local transit logos and the carpool symbol. Letter and numeral sizes for freeway interchange signs are shown in table II-2 (page 2F-5).

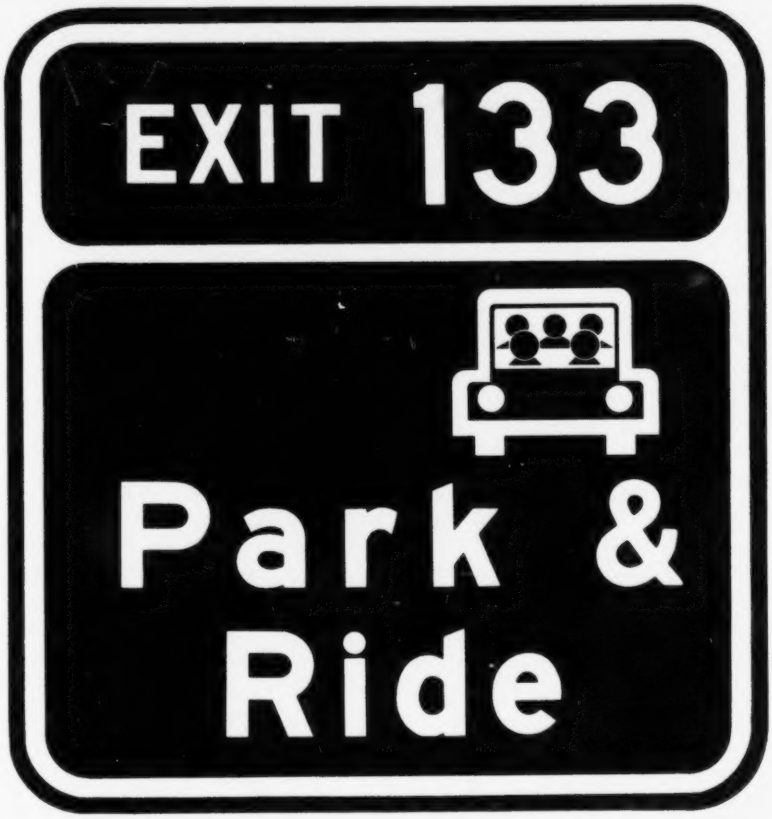


Figure 2-26. Guide sign to park & ride facility. (Freeway).

2F-21 Post Interchange Signs

Where space between interchanges permits, a fixed sequence of post interchange signs should be displayed. The provisions of sections 2E-32 and 2E-33 apply to the use and placement of these signs.

2F-22 Signing by Class of Interchange

Motorists need signs to help identify the geometric layout of interchanges, as well as to obtain route, direction and destination information for specific exit ramps. Signing layouts, therefore, must be consistent for each type of interchange. For the sake of uniform application the significant features of the signing plan for each of the more frequent kinds of interchanges, as described in sections 2F-23 through 2F-32 and illustrated in figures 2-27 through 2-42, should be followed as closely as possible. Where unusual geometric features exist, variations in signing layout are permissible, but should be held to a minimum.

The interchange layouts shown in most of the figures illustrate only the major guide signs for one direction of traffic on the through road and on the crossroad.

2F-23 Interchanges Between Freeways (figs. 2-27 through 2-31)

Interchanges between freeways are major decision points where the effect of taking a wrong ramp cannot be easily corrected. Reversing direction on the crossing highway or reentering to continue on the intended course is usually not possible. The sign messages should contain only the route shield, cardinal direction, and the name of the next control city on that route.

Overhead signs are required at a distance of one mile and at the theoretical gore of each connecting ramp, and may be used at the two mile point. Arrows should point as indicated in section 2D-8, unless a diagramatic representation of the interchange layout requires otherwise. The name of the control city and/or arrow may be omitted on signs which indicate the straight-ahead continuation of a route.

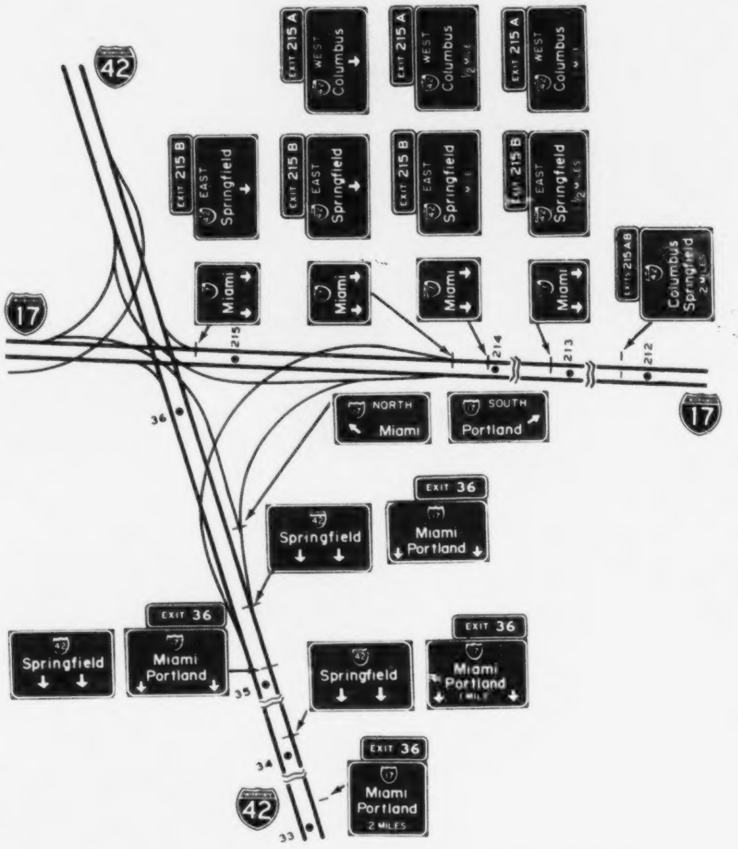
At bifurcations where the off-route movement is to the left or where there is an optional lane split, driver expectancy problems usually result and diagramatic signs should be used at the advance guide sign location. The EXIT ONLY panel shall not be used on diagrammatic signs at any major bifurcation or split.

Two-lane exits with an optional lane can cause driver confusion and diagrammatic signs may be used at the advance guide sign locations (fig. 2-30).

Some two-lane exits with an optional lane carry the through route on the exiting lanes. These interchanges create serious expectancy problems for all drivers. Diagrammatic signs (fig. 2-31) should be used at the advance guide sign locations for this type of interchange.

Warning signs with the message EXIT (35) MPH may be used where an engineering study shows that it is necessary to display a speed reduction message.

When diagrammatic signs are used they shall conform to the provisions of section 2F-24.



42
17
EXIT 215 A
WEST
Columbus
1/2 MILE
1 MILE
EXIT 215 B
EAST
Springfield
1/2 MILES
Miami
EXITS 215 AB
Columbus
Springfield
2 MILES
215
214
213
212
NORTH
Miami
SOUTH
Portland
36
35
34
33
EXIT 36
Springfield
Miami
Portland
1 MILE
2 MILES

Figure 2-27. Split without optional lane having off route to right.

2F-24 Diagrammatic Signs (figs. 2-28 through 2-32, 2-35)

Diagrammatic signs are guide signs that show a graphic view of the exit arrangement in relationship to the main highway. Use of such guide signs have been shown to be superior to conventional guide signs for some interchanges.

Diagrammatic signs should be used at the advance guide sign locations for left exits (fig. 2-32) and for some interchanges in sections 2F-23 and 2F-25. They should be used for splits having off-route movements to the left (fig. 2-28), optional lane splits (fig. 2-29), exits with route discontinuity (fig. 2-31) and left exit lane drops (fig. 2-35). Diagrammatic signs may be used at two-lane exits with an optional lane (fig. 2-30).

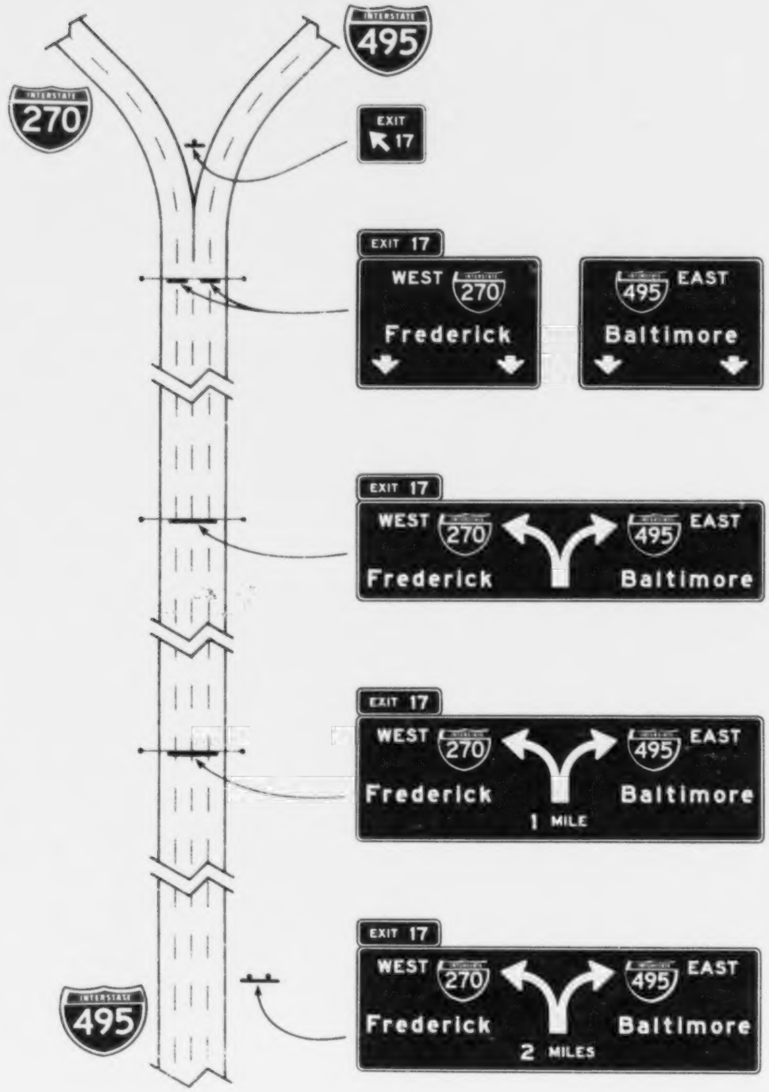

INTERSTATE
495
INTERSTATE
270
EXIT
17
EXIT 17
WEST 270
Frederick
495 EAST
Baltimore
EXIT 17
WEST 270
Frederick
495 EAST
Baltimore
EXIT 17
WEST 270
Frederick
495 EAST
Baltimore
1 MILE
EXIT 17
WEST 270
Frederick
495 EAST
Baltimore
2 MILES
INTERSTATE
495

Figure 2-28. Split without optional lane having off route to left.

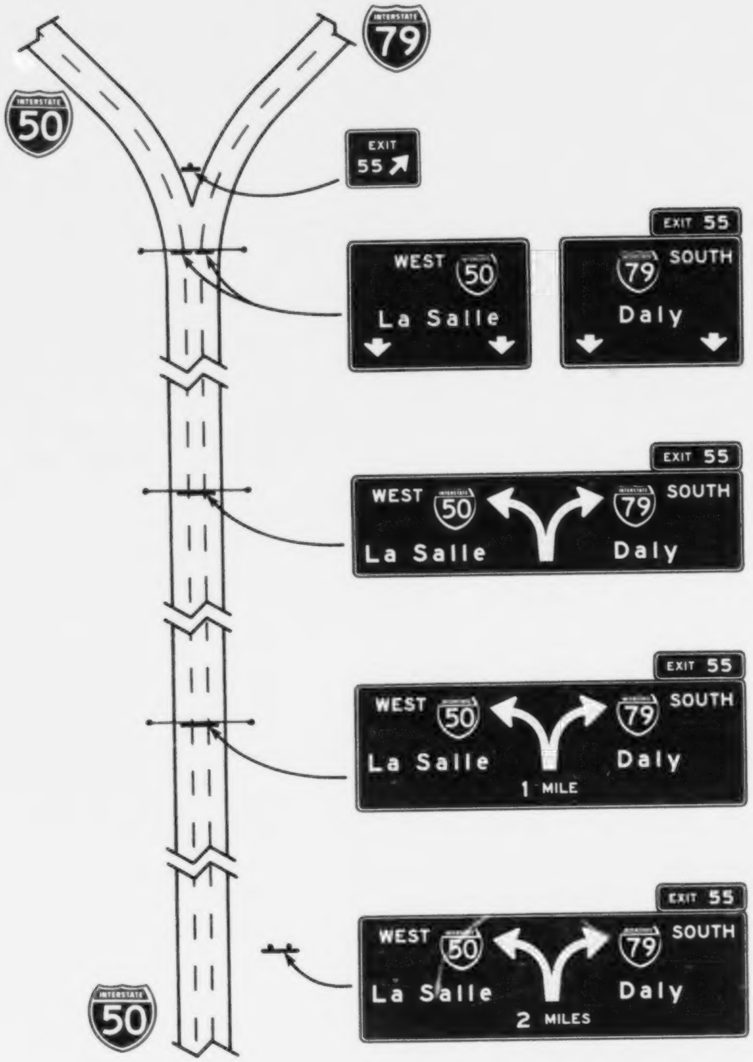

INTERSTATE 79
INTERSTATE 50
EXIT 55
EXIT 55
WEST 50 La Salle
79 SOUTH Daly
EXIT 55
WEST 50 La Salle
79 SOUTH Daly
EXIT 55
WEST 50 La Salle
79 SOUTH Daly
1 MILE
EXIT 55
WEST 50 La Salle
79 SOUTH Daly
2 MILES
INTERSTATE 50

Figure 2-29. Optional lane split (Not overlapping routes).

At cloverleaf interchanges, diagrammatics have been shown to be inferior to conventional signs and shall not be used. Highway departments are encouraged to continue experimentation (sec. 1A-6) with other diagrammatic signing so that standards as contained herein may be updated in future editions of the Manual.

Diagrammatic signs shall be designed in accordance with the following criteria:

1. The graphic legend shall be of a plan view showing a simplified off-ramp arrangement.
2. Only one destination may be shown for each arrowhead, with a maximum of two destinations per sign.
3. The graphic should not depict deceleration lanes. A black on yellow "EXIT ONLY" panel should be used to supplement a lane drop graphic.
4. The shaft for the exit ramp movement should be shorter than but not separated from the through movement graphic.
5. Arrow shafts should contain lane lines where appropriate and route shields shall not be used as a substitute for arrow heads.
6. Route shields, cardinal directions and destinations should be clearly related to the arrowhead and the arrowhead should point toward the route shield for the off movement.
7. The cardinal direction should generally be placed adjacent to the route shield and the destination should be placed below and justified with the route shield.
8. Exit number panels should be located toward the top left edge of the sign for a left exit and toward the top right edge for right exits.

Specific guidelines for more detailed design of these signs are contained in the Standard Highway Signs booklet.*

2F-25 Signing for Interchange Lane Drops (figs. 2-33 through 2-35)

Major guide signs for all lane drops at interchanges shall be mounted overhead. The EXIT ONLY panel(s) (fig. 2-33) shall be used for all interchange lane drops at which the through route is carried on the mainline. The EXIT ONLY panel E11-1 should be used in all new signing of lane drops on all advance guide signs for right-hand exits (fig. 2-34). For lane drops on the left side, diagrammatic signing with the EXIT ONLY panel E11-1c should be used without a down arrow for advance guide signs (fig. 2-35). The exit direction sign for all lane drops shall be of the format shown in E11-1a.

EXIT ONLY messages of either E11-1b or E11-1c formats may be used on existing signing to warn of a lane drop situation ahead. The E11-1b panel shall be placed on either side of a white down arrow. The

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*Available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590

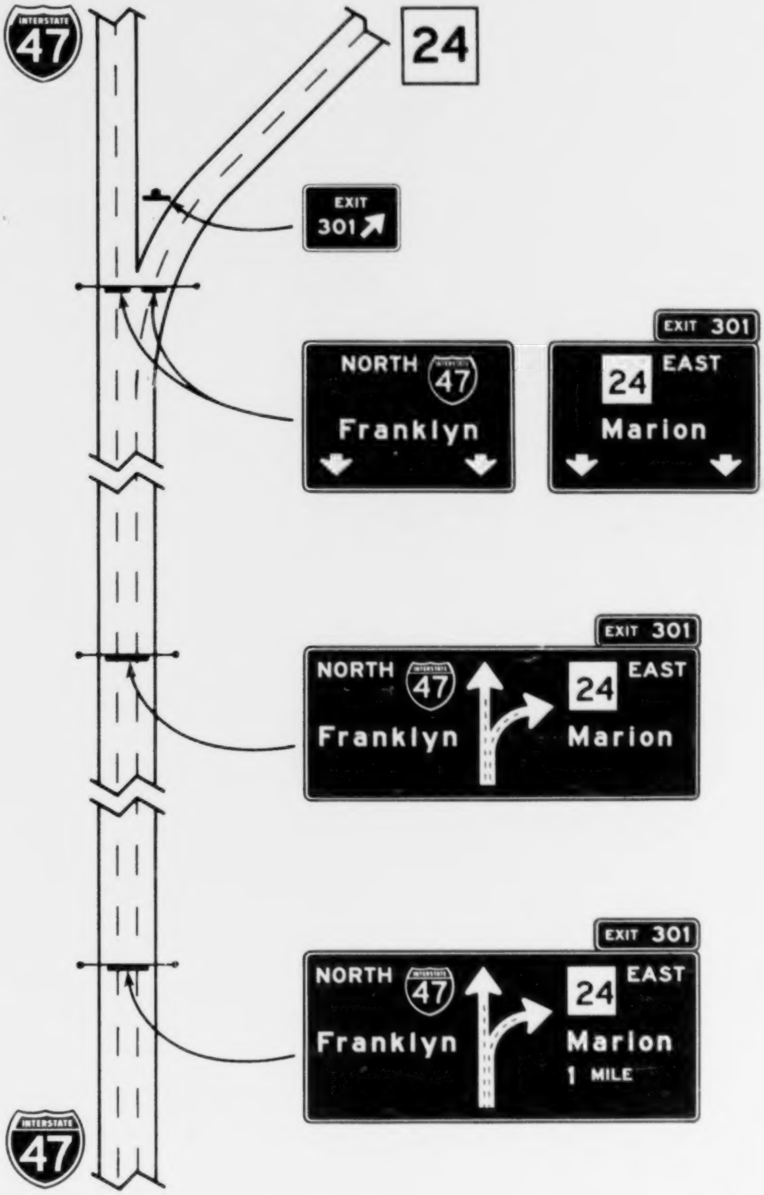

INTERSTATE
47
24
EXIT
301
EXIT 301
NORTH 47
Franklyn
24 EAST
Marion
EXIT 301
NORTH 47
Franklyn
24 EAST
Marion
EXIT 301
NORTH 47
Franklyn
24 EAST
Marion
1 MILE
INTERSTATE
47

Figure 2-30. Two-lane exit with optional lane.

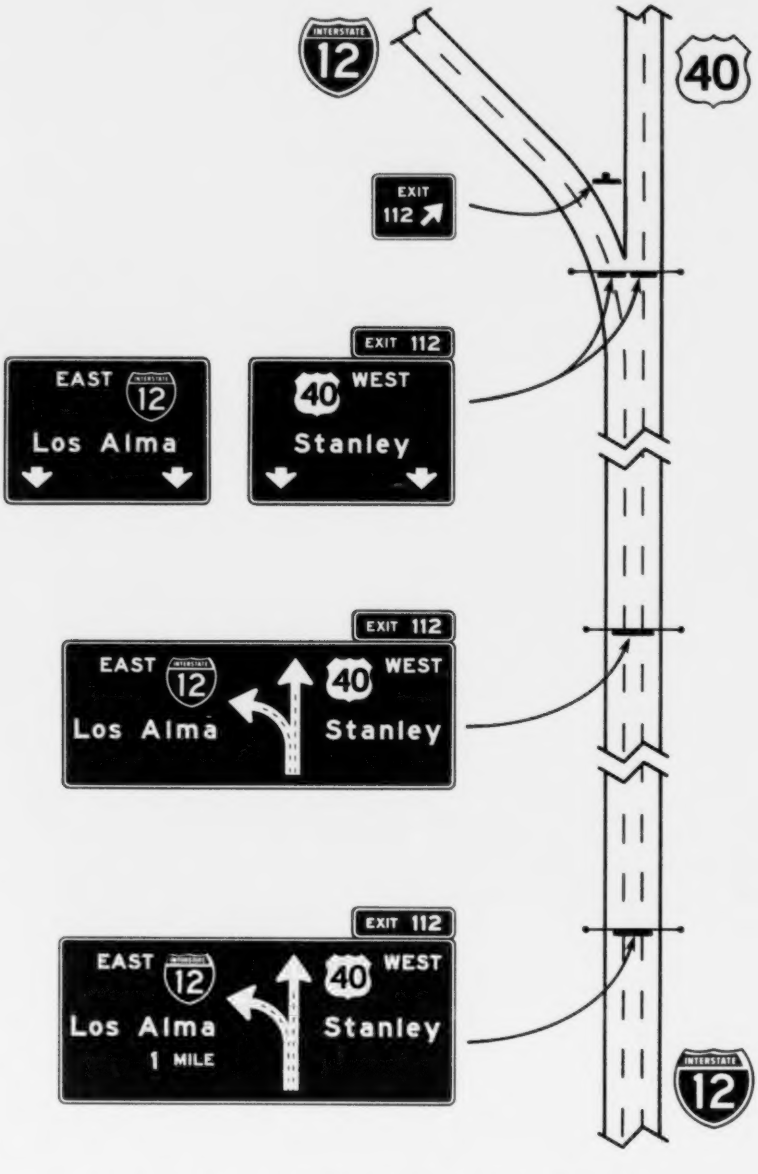

INTERSTATE 12
40
EXIT 112
EAST INTERSTATE 12
Los Alma
EXIT 112
40 WEST
Stanley
EXIT 112
EAST INTERSTATE 12
Los Alma
40 WEST
Stanley
EXIT 112
EAST INTERSTATE 12
Los Alma
1 MILE
40 WEST
Stanley
INTERSTATE 12

Figure 2-31. Two-lane exit with optional lane and route discontinuity.

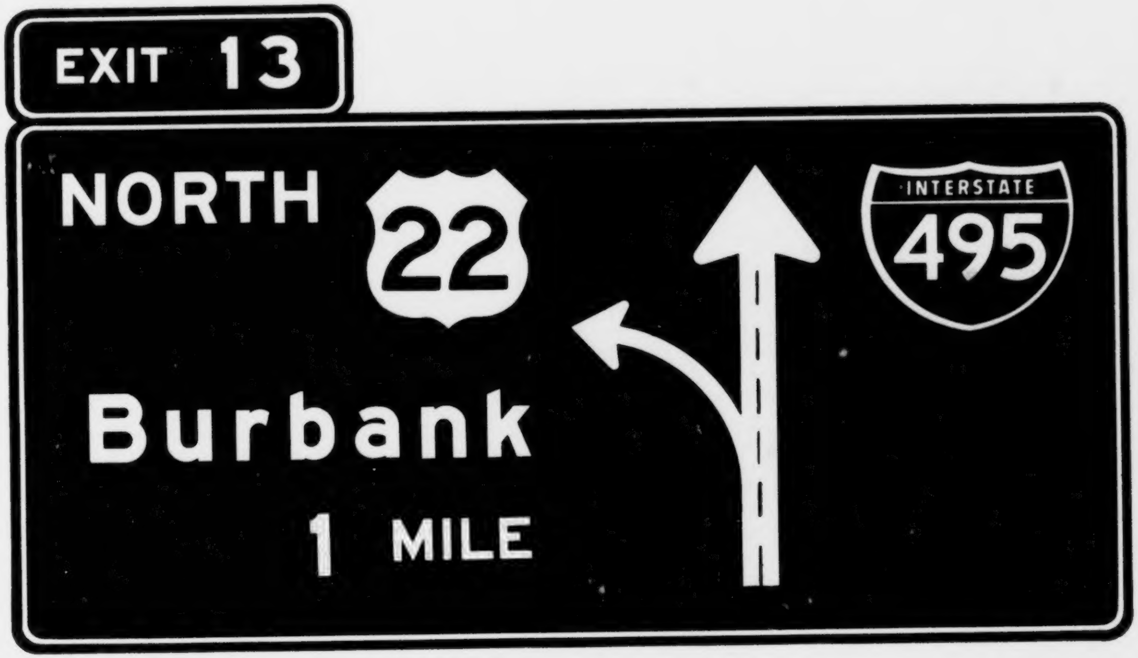

EXIT 13
NORTH
22
Burbank
1 MILE
INTERSTATE
495

Figure 2-32. Diagrammatic sign for single left exit.

E11-1c panel, when used on a nondiagrammatic sign, shall be placed between the lower destination message and the white down arrow.

A standard up arrow (left or right side) shall be used with the EXIT ONLY E11-1a panel at the exit direction sign location. One and two mile advance guide signs, when used, shall contain the distance message. Advance guide signs for lane drops within one mile of the interchange should not contain the distance message.

Wherever the dropped lane carries the through route, diagrammatic signs should be used without the EXIT ONLY panel.

2F-26 Cloverleaf (fig. 2-36)

This type of interchange has two exits for each direction of travel. The exits are closely spaced and have common advance guide signs. The advance guide signs should include two place names, one corresponding to each exit ramp, with the name of the place served by the first exit on the upper line. An overhead sign shall be placed at the theoretical gore point of the first exit ramp, with an upward slanting arrow on the sign for that exit and the message ($^1/_4$) MILE on the sign for the second exit, as shown in figure 2-36.

The second exit shall be indicated by an overhead exit direction sign over the auxiliary lane mounted on the structure if the freeway passes under the crossroad, or on a cantilever or full-span structure if the freeway passes over the crossroad. A gore sign shall also be used at each exit.

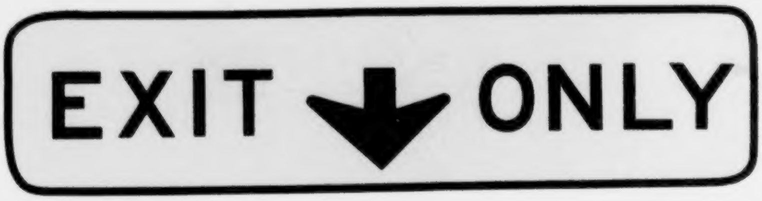
Exit numbers shall not indicate the cardinal directions of the cross route. Interchanges with more than one exit from the main line shall be numbered as described in section 2F-19 with an appropriate suffix.

2F-27 Cloverleaf with Collector-Distributor Roadways (fig. 2-37)

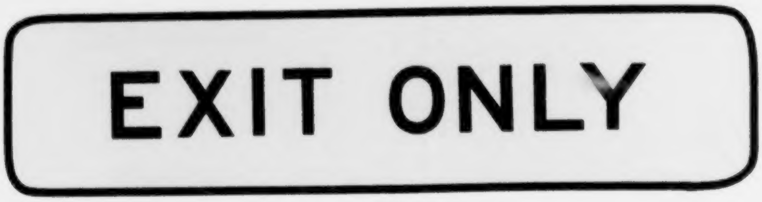
Signing on the collector-distributor roadway shall be basically the same as on a cloverleaf interchange. However, the advance guide signs shall use the singular EXIT as shown in the figure. Exits from the collector-distributor road shall not be numbered. Signs for these exits shall be overhead and located at the theoretical gore of the collector-distributor roadway and the exit ramp.

2F-28 Partial Cloverleaf (fig. 2-38)

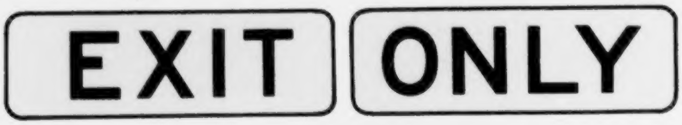
As in the figure, the overhead exit direction sign should be placed on the structure if the freeway passes under the crossroad and the exit roadway is located beyond the structure. A gore sign shall also be used.



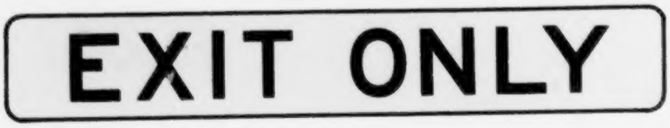
E11–1



E11–1a



E11–1b



E11–1c

Figure 2-33. Exit only panel.

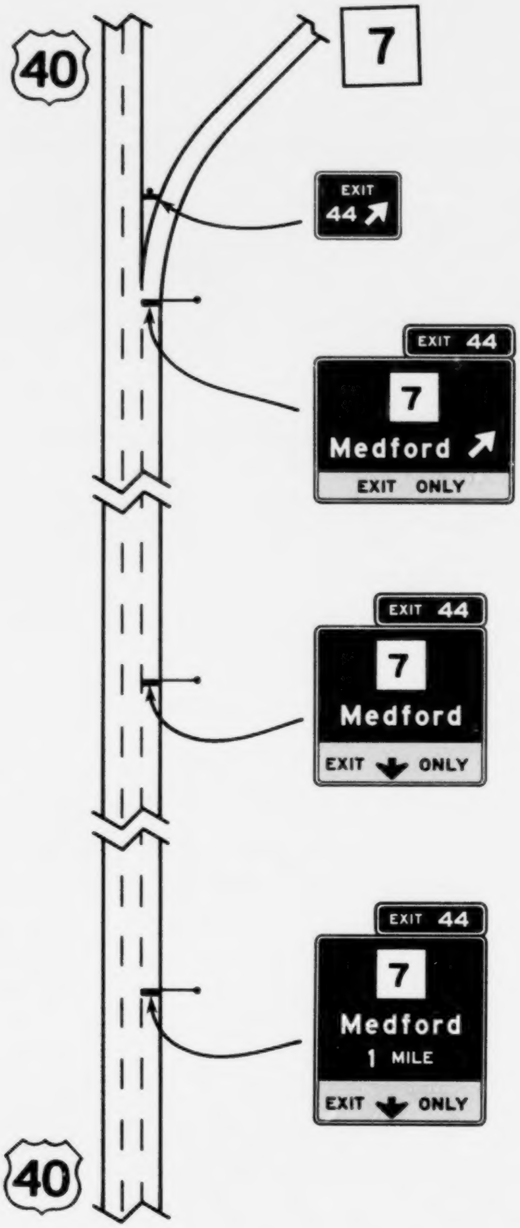

40
7
EXIT
44
EXIT 44
7
Medford
EXIT ONLY
EXIT 44
7
Medford
EXIT ONLY
EXIT 44
7
Medford
1 MILE
EXIT ONLY
40

Figure 2–34. EXIT ONLY on right (Right hand interchange lane drop).

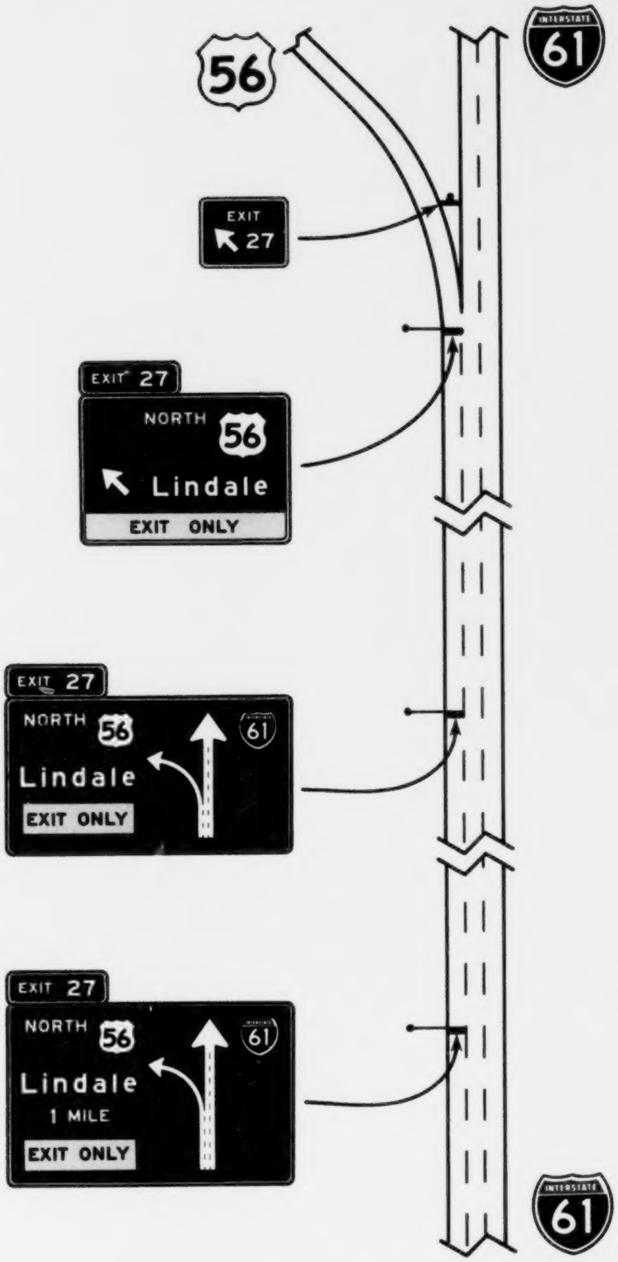

56
INTERSTATE
61
EXIT
27
EXIT 27
NORTH
56
Lindale
EXIT ONLY
EXIT 27
NORTH
56
61
Lindale
EXIT ONLY
EXIT 27
NORTH
56
61
Lindale
1 MILE
EXIT ONLY
INTERSTATE
61

Figure 2-35. EXIT ONLY on left with diagrammatic (Left-hand interchange lane drop).

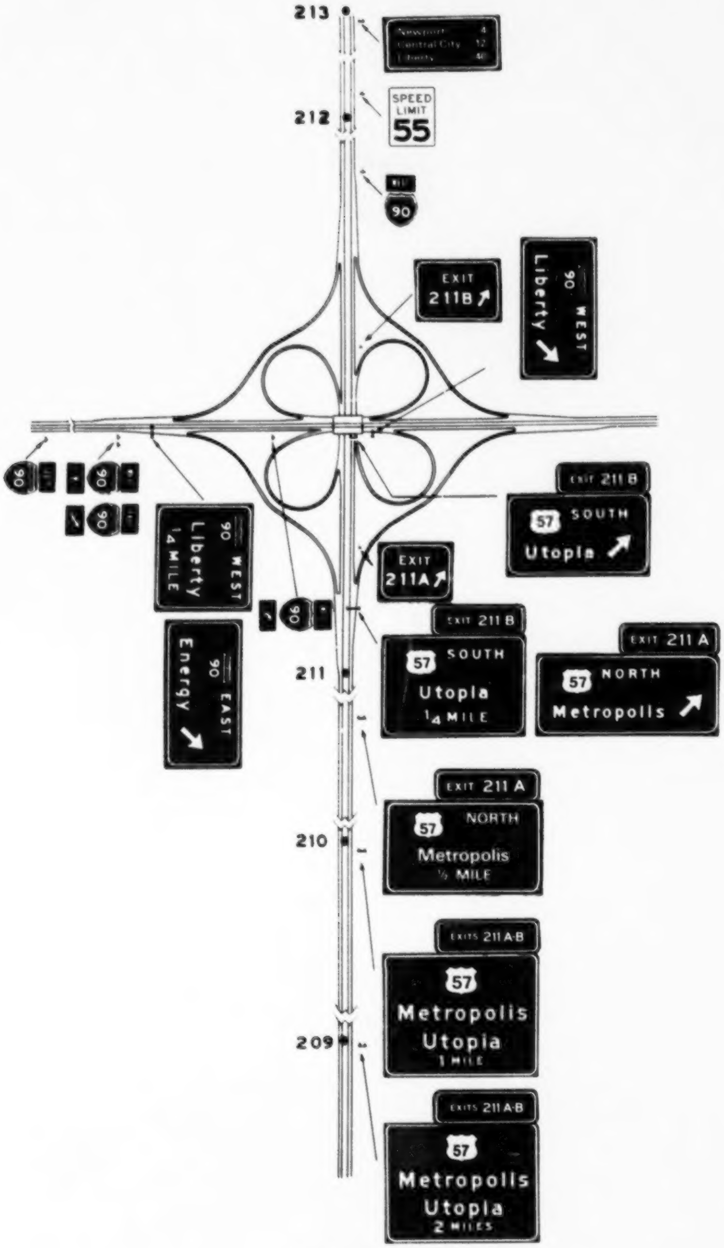

213
Newport 4
Central City 12
Liberty 40
212
SPEED LIMIT 55
90
EXIT 211B
90 WEST Liberty
90
90
90
90 WEST Liberty ¼ MILE
90 EAST Energy
EXIT 211 B
57 SOUTH Utopia
EXIT 211A
90
EXIT 211 B
57 SOUTH Utopia ¼ MILE
EXIT 211 A
57 NORTH Metropolis
211
EXIT 211 A
57 NORTH Metropolis ½ MILE
210
EXITS 211 A-B
57 Metropolis Utopia 1 MILE
209
EXITS 211 A-B
57 Metropolis Utopia 2 MILES

Figure 2-36. Cloverleaf interchanges.

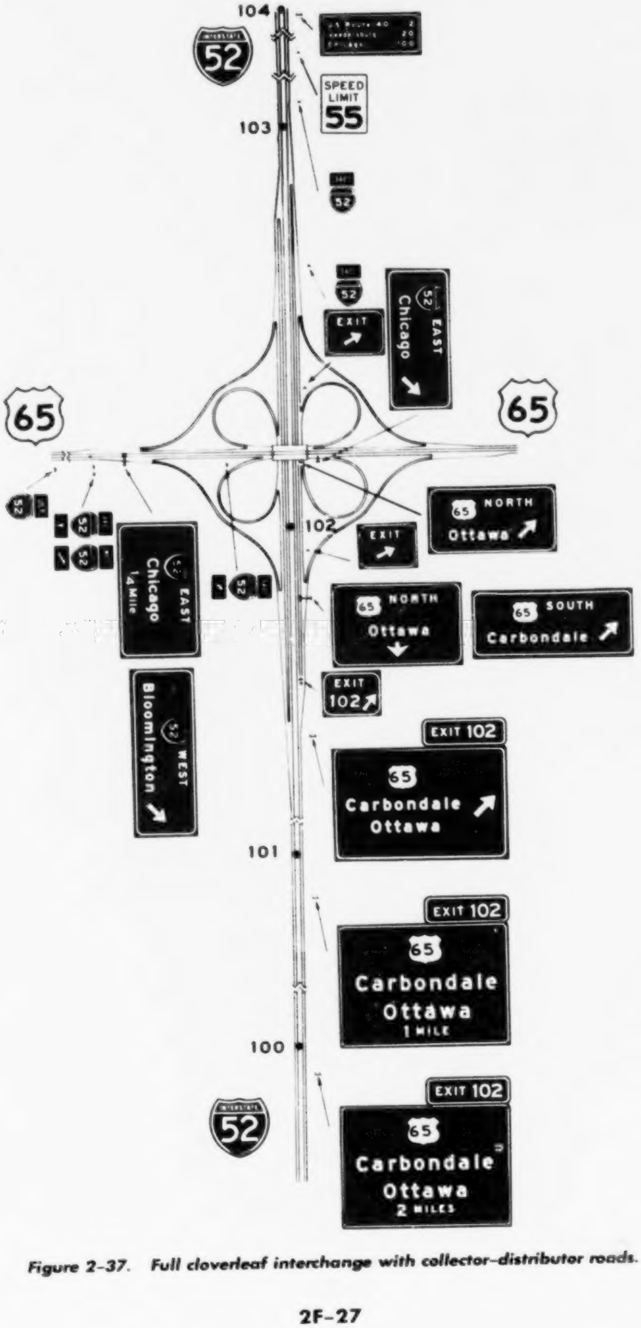

104
INTERSTATE 52
SPEED LIMIT 55
103
52
EXIT
52 EAST Chicago
65
65
NORTH Ottawa
102
EXIT
52 EAST Chicago 1/4 Mile
65 NORTH Ottawa
65 SOUTH Carbondale
EXIT 102
52 WEST Bloomington
EXIT 102
65 Carbondale Ottawa
101
EXIT 102
65 Carbondale Ottawa 1 MILE
100
EXIT 102
65 Carbondale Ottawa 2 MILES
INTERSTATE 52

Figure 2-37. Full cloverleaf interchange with collector-distributor roads.

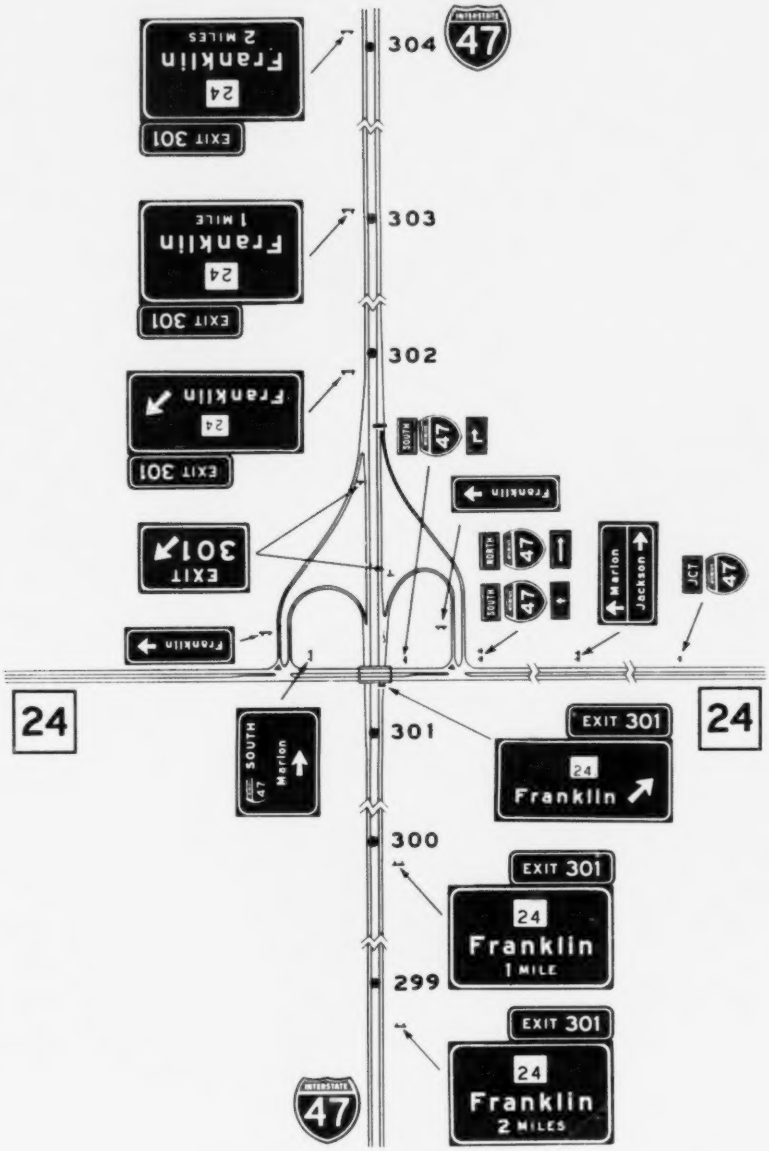

INTERSTATE 47
304
EXIT 301
24 Franklin 2 MILES
303
EXIT 301
24 Franklin 1 MILE
302
EXIT 301
24 Franklin
SOUTH 47
Franklin
EXIT 301
NORTH 47
SOUTH 47
Marion
Jackson
JCT 47
Franklin
24
24
SOUTH 47 Marion
301
EXIT 301
24 Franklin
300
EXIT 301
24 Franklin 1 MILE
299
EXIT 301
24 Franklin 2 MILES
INTERSTATE 47

Figure 2-38. Partial cloverleaf interchange.

2F-29 Diamond (fig. 2-39)

The signing layout for all interchanges having only one exit ramp in the direction of travel should be similar, regardless of the interchange type (figs. 2-37 through 2-40). The singular message EXIT shall be used on advance guide and exit direction signs. Exit numbers shall not include the cardinal initials corresponding to the direction of the cross route.

The typical diamond interchange ramp departs from the mainline roadway such that a speed reduction generally is not necessary in order for a driver to safely negotiate an exit manuever from the mainline into the ramp roadway. When this is the case an exit speed sign should not be used. A Stop Ahead or Signal Ahead warning sign may be placed, where an engineering study indicates a need, along the ramp in advance of the cross street to give notice to the driver so that a safe stop may be made. When used, these signs should be used in pairs with one sign on each side of the ramp for two lane ramps and singly for one lane ramps.

When a ramp departs from the mainline and when there is a curve present that will cause a significant speed reduction, an Exit Speed sign may be posted based on an engineering study. The Exit Speed sign should then be located along the deceleration lane or along the ramp such that it is visible to the driver far enough in advance so that a safe slowing and exiting maneuver may be made.

2F-30 Urban Diamond (fig. 2-40)

In urban areas, street names are often shown as the principal message in destination signs. If interchanges are too closely spaced to properly locate the advance guide signs, they may be placed closer to the exit, and the mileage figures adjusted accordingly. Where two or more serve the same community, the Community Interchanges Identification sign is useful in helping motorists make a choice of exits. The signing layout is as shown in figure 2-40, (page 2F-31).

2F-31 Closely Spaced Interchanges (fig. 2-41)

When a series of interchanges is closely spaced, the advance guide sign for the next interchange should be mounted on an overhead structure located downstream from the gore of the preceding interchange. Information for more than one interchange shall not be shown on such signs.

Interchange sequence series signs should be used. When used, they should identify and show street names and distance for the next three exits, as shown in figure 2-41 (page 2F-32).

2F-32 Minor Interchange (fig. 2-42)

A lower standard of signing is prescribed for a minor interchange because such an interchange customarily serves low volumes of local traffic only. The size of messages to be used is shown in table II-2 (page 2F-5).

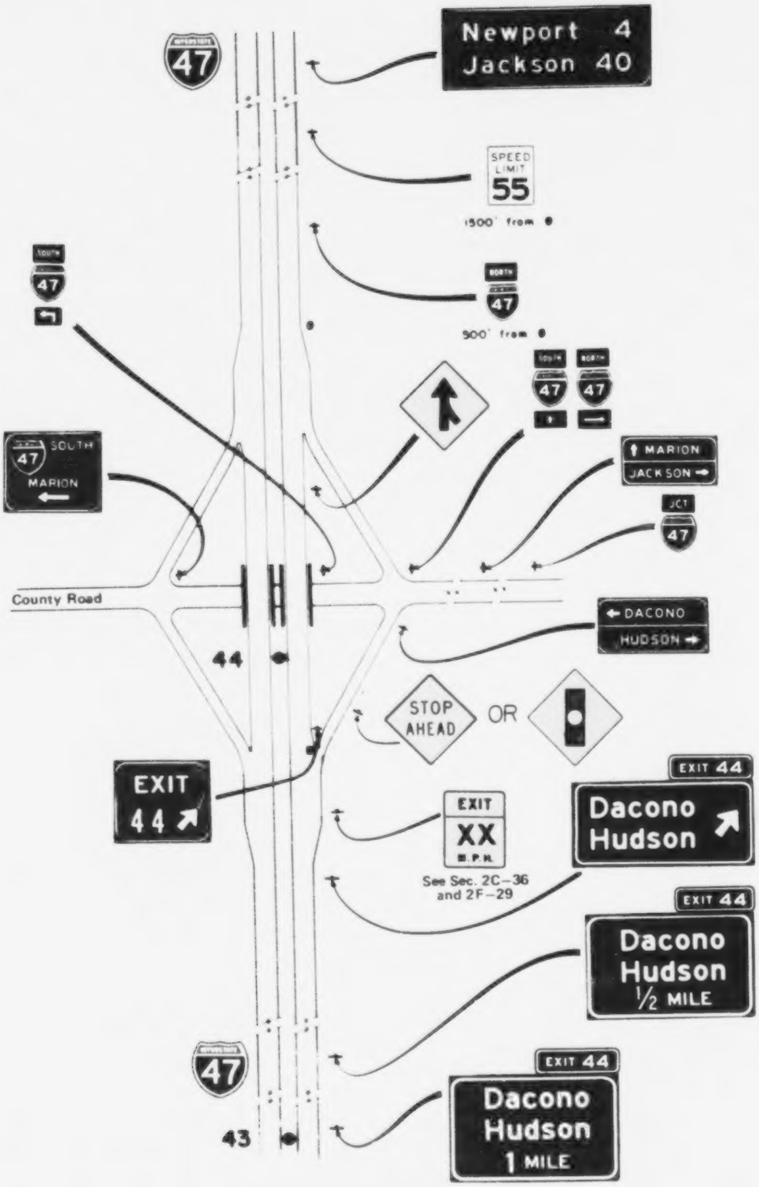

47
Newport 4
Jackson 40
SPEED LIMIT 55
1500' from ●
SOUTH
47
NORTH
47
900' from ●
SOUTH
47
NORTH
47
47 SOUTH
MARION ←
↑ MARION
JACKSON →
JCT
47
County Road
← DACONO
HUDSON →
44
STOP AHEAD
OR
EXIT 44 ↗
EXIT
XX
M.P.H.
See Sec. 2C-36 and 2F-29
EXIT 44
Dacono
Hudson ↗
EXIT 44
Dacono
Hudson
½ MILE
47
EXIT 44
Dacono
Hudson
1 MILE
43

Figure 2-39. Diamond interchange.

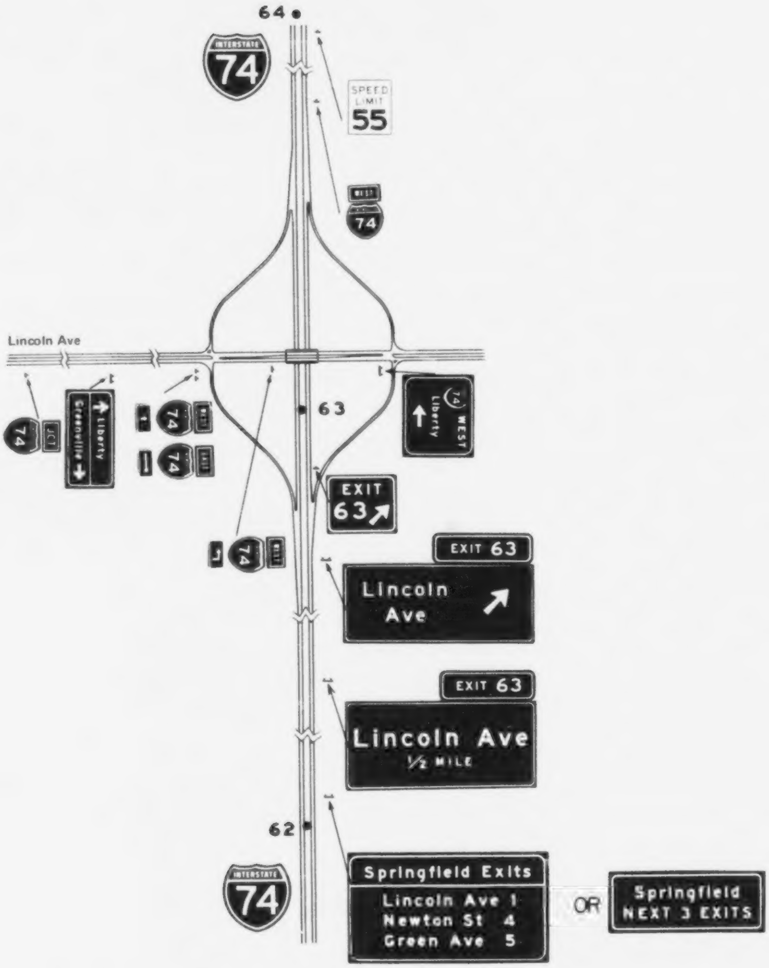

64
INTERSTATE
74
SPEED LIMIT
55
WEST
74
Lincoln Ave
JCT
74
Liberty
Greenville
74
WEST
63
74
WEST
Liberty
EXIT
63
EXIT 63
Lincoln
Ave
EXIT 63
Lincoln Ave
½ MILE
62
INTERSTATE
74
Springfield Exits
Lincoln Ave 1
Newton St 4
Green Ave 5
OR
Springfield
NEXT 3 EXITS

Figure 2-40. Urban diamond interchange.

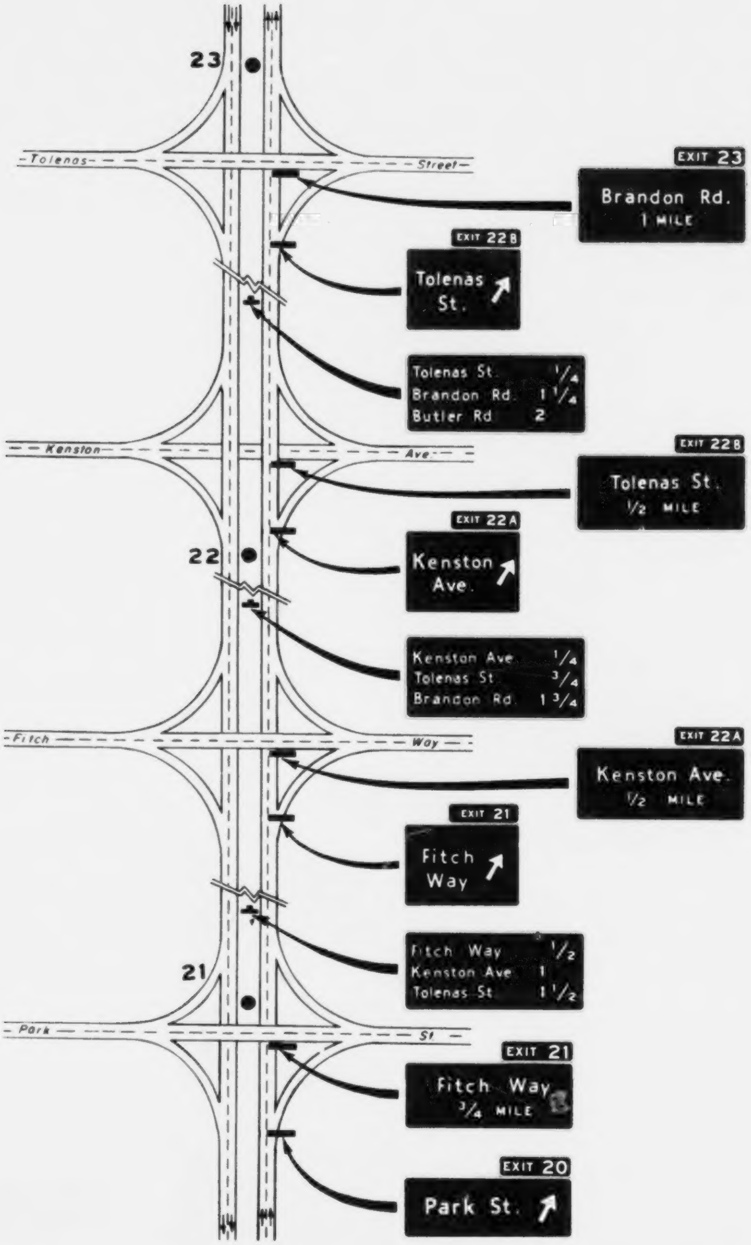
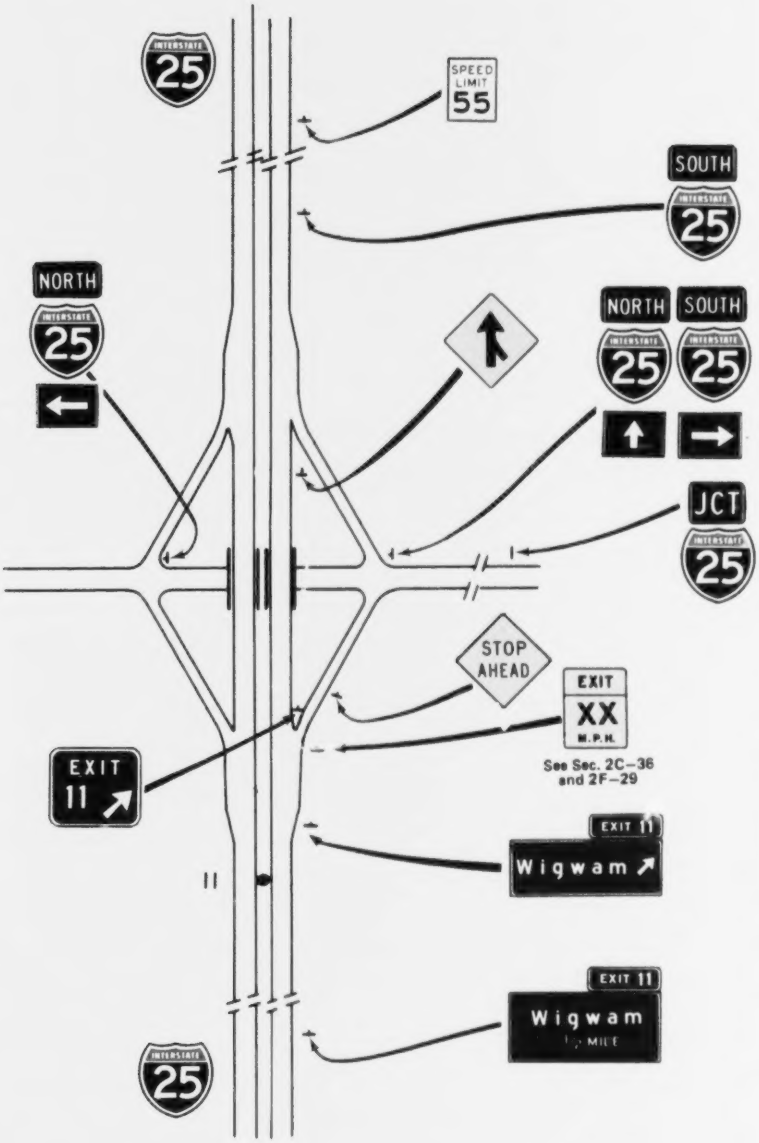

23
Tolenas
Street
EXIT 23
Brandon Rd.
1 MILE
EXIT 22B
Tolenas St.
Tolenas St. 1/4
Brandon Rd. 1 1/4
Butler Rd 2
Kenston
Ave
EXIT 22B
Tolenas St.
1/2 MILE
EXIT 22A
Kenston Ave.
22
Kenston Ave. 1/4
Tolenas St. 3/4
Brandon Rd. 1 3/4
Fitch
Way
EXIT 22A
Kenston Ave.
1/2 MILE
EXIT 21
Fitch Way
Fitch Way 1/2
Kenston Ave. 1
Tolenas St 1 1/2
21
Park
St
EXIT 21
Fitch Way
3/4 MILE
EXIT 20
Park St.

Figure 2-41. Series of closely spaced interchanges using sequence signs and sign spreading.


INTERSTATE
25
SPEED
LIMIT
55
SOUTH
INTERSTATE
25
NORTH
INTERSTATE
25
←
NORTH
SOUTH
INTERSTATE
25
INTERSTATE
25
↑
→
JCT
INTERSTATE
25
STOP
AHEAD
EXIT
XX
M.P.H.
EXIT
11 ↗
EXIT 11
Wigwam ↗
11
EXIT 11
Wigwam
1/2 MILE
INTERSTATE
25

See Sec. 2C-36
and 2F-29

Figure 2-42. Minor interchange.

At least one advance guide sign and a gore sign shall be placed at a minor interchange, as shown in figure 2-42. An exit direction sign should also be used.

2F-33 Signing for General Motorist Services (fig. 2-43)

Although there are no commercial services available to the traveler between interchanges it is expected that adequate fuel, motor services, food service and lodging will be available near most major interchange sites. It is also assumed that service signing will not be required in urban areas. However, on those rural sections where such services are infrequent, the driver will need information to enable him to plan his stops. Interchange numbers may be shown on service signs as shown in figure 2-43. Action messages may be EXIT ¼ MILE or EXIT 1 MILE, etc. (see sec. 2E-37 and fig. 2-21, page 2E-22).

Only services that adequately serve the needs of the freeway motorist should be shown. Where services are not within sight of the interchange, the road authority shall repeat the service signing in smaller size, on the intersecting highways, with arrows indicating the direction to the services. Distances to services not within the immediate interchange area should be shown. All approved symbols shall be permitted as alternates to word messages wherever motorist service signs are used, but intermixing of symbols and word legends shall not be permitted. Service signing should only be provided at interchanges where the motorist can return to the freeway and continue in the same direction of travel.

Where road authorities elect to provide service signing, there should be a statewide policy for such signing and criteria for the availability of the various types of services. The criteria should include the following:

1. Gas, Diesel, and/or LP-Gas II-65(c) Rev. 4
    a. Vehicle services such as fuel, oil, lubrication, tire repair and water.
    b. Restroom facilities and drinking water.
    c. Continuous operation at least 16 hours per day, 7 days a week.
    d. Telephone.
2. Food
    a. Licensing or approval, where required.
    b. Continuous operation to serve 3 meals a day, 7 days a week.
    c. Telephone.
3. Lodging
    a. Licensing or approval, where required.
    b. Adequate sleeping accommodations.
    c. Telephone.
4. Telephone
    a. Continuous operation, 7 days a week.

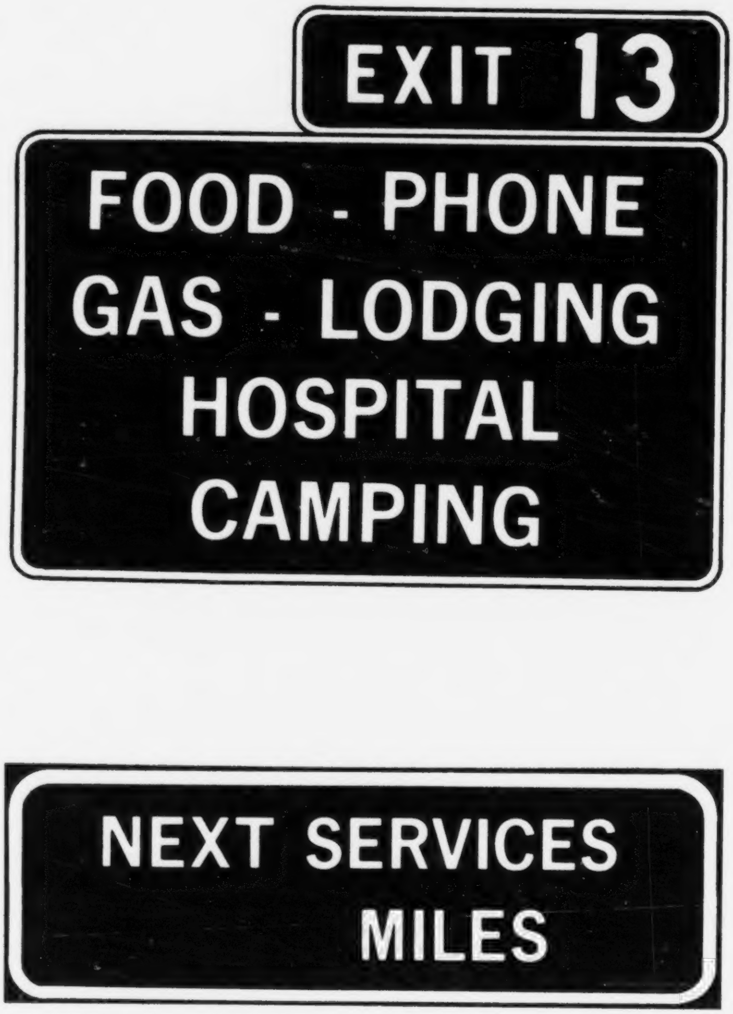

EXIT 13
FOOD - PHONE
GAS - LODGING
HOSPITAL
CAMPING
NEXT SERVICES
MILES

Figure 2-43. Motorist services signs.

5. *Hospital*
   a. Continuous emergency care capability, with a doctor on duty 24 hours a day, 7 days a week. A doctor on duty would include the following criteria and should be signed in accordance with the priority as follows:
      (1) Physician on duty within the emergency department.
      (2) Registered nurse on duty within the emergency department, with a physician in the hospital on call.

(3) Registered nurse on duty within the emergency department, with a physician on call from his office or home.

6. Camping
   a. Licensing or approval where required.
   b. Adequate parking accommodations.
   c. Modern, sanitary facilities and drinking water.
   d. Signs to be removed if operated on a seasonal basis only.

The service sign shall be mounted in an effective location, between the advance guide sign and the exit direction sign, in advance of the exit leading to the services available and should contain the interchange number. If the distance to the next point where services are available is greater than 10 miles, a sign "Next Services (xx) Miles" shown in figure 2-43, may be used as a separate panel mounted under the exit direction sign.

Freeway signs for services shall conform to the provisions for general motorist service signs covered in sections 2D-46, 2E-37 and as specified herein. Letter and numeral sizes for freeway design are given in table II-2. No more than six general motorist services are to be displayed on one sign (including appended panel). The qualified services available should be shown at specific locations on the sign, and the sign space normally reserved for a given service symbol or word is to be left blank when that service is not present, to provide flexibility for the future when the service may become available.

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Rev. 1

The standard display of word messages recommended is FOOD and PHONE in that order on the top line, and GAS and LODGING on the second line. Where used, HOSPITAL and CAMPING should be on separate lines. Signing for DIESEL and LP-Gas service may be substituted for any of the General Motorist Services or appended to such signs. The International Symbol of Access for the Handicapped sign (D9-6) may be used for facilities that quality (sec. 2D-46).

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When symbols are used for the motorist services they should be displayed as follows:

6 Services
1. TOP ROW-GAS, FOOD, and LODGING
BOTTOM ROW-PHONE, HOSPITAL, and CAMPING

4 Services
2. TOP ROW-GAS and FOOD
BOTTOM ROW-LODGING and PHONE

3 Services
3. TOP ROW-GAS, FOOD, and LODGING

Substitutions of other services for any of the services shown above may be made by placing the substitution in the lower right (2) or extreme right

(3) portion of the panel. An action message or an interchange number may be used as they are used for word message signs. The diesel fuel symbol (D9-11) or the LP-Gas symbol (D9-15) may be substituted for the symbol representing gas or appended to such assemblies. The information symbol may be substituted on any of the above configurations. II-65(c) Rev. 4

At rural interchange areas where limited motorist services are available and where it is unlikely that additional services will be provided within the near future, a panel having one to three services (words or symbols) may be appended to ground mounted interchange guide signs. Should additional services become available at such locations in the future, the appended sign panel shall be removed and replaced with an independently mounted motorist service sign as described above. When sign panels are appended, the requirements of sections 2A-23 and 2F-17 shall apply.

A separate telephone service sign (sec. 2D-46) may be erected when telephone facilities are located adjacent to the freeway at places where telephones would not normally be expected.

The Recreational Vehicle Sanitary Station sign (D9-12) may be used as needed to indicate the availability of facilities designed for the use of dumping wastes from recreational vehicle holding tanks.

In some locations, signs may be useful to indicate that services are not available.

2F-34 Rest and Scenic Area Signs (fig. 2-44)

II-1(c) Rev. 4

On the approach to rest areas, an advance guide sign shall be placed one mile or two miles in advance of the rest area. If the rest area has facilities for the physically handicapped (sec. 2D-46), the International Symbol of Access for the Handicapped Sign (D9-6) may be placed with or beneath the advance rest area sign. Between the advance guide sign and the gore of the rest area exit, there may be sign reading REST AREA which shall carry either an arrow or the words NEXT RIGHT as a part of the message.

At the rest area exit gore, there shall be a sign with a message REST AREA together with an arrow indicating the appropriate turn as shown in figure 2-44. A roadside area that does not contain restroom/toilets should be signed to indicate the major motorist service provided. An area with only parking would be signed PARKING AREA. An area with picnic tables and parking would be signed PICNIC AREA. All signs for rest areas shall have reflectorized white letters, symbols, and borders on a blue background.

To provide the motorist with information on the location of succeeding rest areas a sign with the word message NEXT REST AREA XX MILES may be installed independently or as a supplemental panel mounted below one of the advance rest area guide signs. The supplemental panel may be used with one of the advance guide signs for rest areas that have tourist information and welcome centers. Before a supplemental panel is installed II-36 (c) Rev. 2

with tourist information or welcome center signs, a study should be conducted to make sure the additional information will not overload the motorist on this section of roadway. II-36 (c) Rev. 2

Rest areas that have tourist information and welcome centers should be signed as discussed in section 2F-36.

Scenic area signing should be consistent with that specified for rest areas. Standard messages should read SCENIC AREA or SCENIC VIEW or the equivalent.

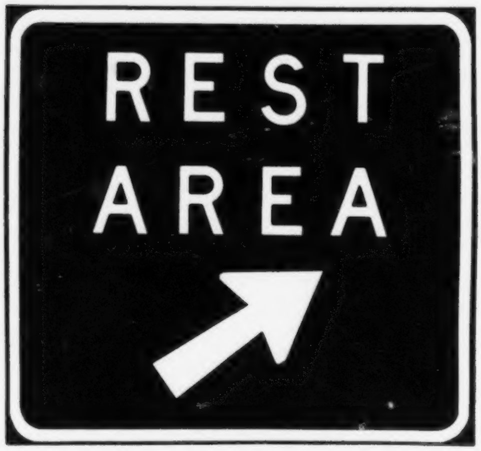


Figure 2-44. Freeway rest area gore sign.

2F-35 Tourist Information and Welcome Centers

II-1(c) Rev. 4

Tourist information centers have been constructed within rest areas on the Interstate System and other freeways and are operated by either a State or a private organization. Others have been located within close proximity to these facilities and operated by civic clubs, chambers of commerce, or private enterprise.

The following criteria for signing should prevail regardless of the location of the tourist information center:

1. Tourist information center signs shall have a white reflectorized legend and border on a blue background.
2. The name of the operating agency, community, group, or enterprise shall not appear in the legend of any sign.
3. Continuous staffed or unstaffed operation 8 hours a day, 7 days a week is required.
4. Additional criteria as developed by individual States may be used.

If operated only on a seasonal basis, the signs indicating Tourist Info shall be removed during the off-seasons.

Welcome centers have been constructed within rest areas on the Interstate System and other freeways and are generally operated by a State.

The following criteria for signing should prevail:

1. Welcome center signs shall have a white reflectorized legend and border on a blue background.
2. Welcome centers should be located only at or near State boundaries.
3. The use of the State name is optional.
4. Continuous staffed operation 8 hours a day, 7 days a week is required.
5. Additional criteria as developed by individual States may be used.

For freeway rest area locations, additional signing criteria are as follows:

1. The locations for advance guide, exit direction, and gore signs are to meet service signing requirements.
2. If the signing for the tourist information or welcome center is to be accomplished in conjunction with the initial signing for the rest areas, the message on the advance guide sign should be "REST AREA, TOURIST INFO CENTER, _______ MILE(S) or "REST AREA, STATE NAME (optional), WELCOME CENTER _______ MILE(S)." On the exit direction sign the message should be "REST AREA, TOURIST INFO CENTER" with upward sloping arrow or "NEXT RIGHT;" or 'REST AREA, STATE NAME (optional), WELCOME CENTER" with upward sloping arrow or "NEXT RIGHT."
3. If the initial rest area advance and exit direction signing is in place, these signs should include, on supplemental panels, the legend "TOURIST INFO CENTER" or "STATE NAME (optional), WELCOME CENTER." An alternate to this supplemental TOURIST INFO" legend is the Information Symbol sign (D9-10) which may be appended beneath the Rest Area sign. When incorporated in existing sign installations, such panels must be attached so as not to interfere with existing breakaway support action.
4. The gore sign should contain only the legend "REST AREA" with the arrow and not be supplemented with any legend pertaining to the tourist information center or welcome center.

For information centers located off the Interstate or other freeway facility, the following additional signing criteria shall apply:

1. Each State should have or develop a policy establishing the maximum distance the information center can be located from the interchange in order to be included on official signs.

2. The location of signing should be in accordance with requirements pertaining to service signing but as an alternate, the Information Symbol sign (D9-10) may be appended to the guide signs for the exit providing access to the information center. As a second alternative, it may be combined with general motorist services signing.

3. Signing along the crossroad should be installed to guide the motorist from the interchange to the information center.

A temporary sign may be used to advise motorists that at the next rest area there are special facilities for a "Safety Break." The legend "Safety Break Free Coffee" shall be in white on a blue background in one of two formats:

1. Using 10-inch Series D uppercase letters, the sign would be 4 feet in height with a minimum width of 12 feet or can be longer to match the width of the accompanying Rest Area or Tourist Information Center sign, or

2. Using 6-inch Series D uppercase letters, the sign would be 4 feet in width by 5 feet in height for attachment to one of the supports of the Rest Area or Tourist Information Center signs.

The temporary safety break sign should be so constructed that it may be hung beneath existing signs, attached to existing supports or independently mounted and shall be visible to motorists only during the time the facility is in operation and then removed. It shall not in any way affect the breakaway characteristics of the sign to which it will be attached.

2F-36 Radio Information Signing

II-1(c)
Rev. 4

Radio-Weather Information signs (D12-1) may be used on rural highways where weather commonly creates an undue hazard.

The criteria for signing for radio-weather information is as follows:

1. Radio-Weather Information signs shall have a white legend and border on a blue background.

2. Only the numerical indication of the radio frequency shall be used to identify a station broadcasting weather travel information.

3. A maximum of four frequencies may be shown on each sign.

4. The radio station should have a signal strength to adequately serve 70 miles along the roadway.

5. Signs should be spaced according to needs, but ordinarily not closer than 30 miles apart for each direction of travel.

6. A particular radio frequency may be shown a maximum of twice in one direction along the main line.

7. Only radio stations whose signal will be of value to the traveler and who agree to carry the two items below are to be identified on weather information signs.

a. Periodic weather warnings at no more than 15 minute intervals during periods of adverse weather.

b. Road condition information affecting the roadway being traveled once every half hour when required, supplied by an official agency having jurisdiction.

8. The stations to be included on the signs should be selected in cooperation with the association(s) representing major broadcasting stations in the area to provide (1) maximum coverage to all motorists on both AM and FM frequencies and (2) consideration of 24 hours a day, 7 days a week broadcast capability.

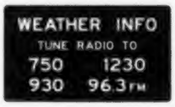
9. Additional criteria may be developed by individual states.

10. If a station to be considered operates only on a seasonal basis, its signs shall be removed or covered during the off-season.

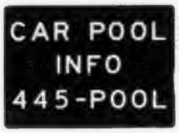
A Channel 9 Monitored sign (D12-3) may be installed as needed. Only official government agencies or their designee may be shown as the monitoring agency on the sign. This sign shall have reflectorized white letters and border on a reflectorized blue background.

II-12(c)
Rev. 2

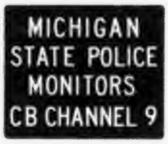
For roadway rest area locations a smaller sign using a greater number of radio frequencies but of the same general design may be used. Rest area signs shall not be erected as to be visible from the main roadway.



D12-1



D12-2



D12-3

2F-37 Carpool Information Signing

II-1(c)
Rev. 4

In urban areas having carpool matching services it is considered in the public interest to permit the use of carpool information signs (D12-2) not only adjacent to preferential lanes but along any urban highway. As this is an information sign related to motorist services it should have a white legend on a blue background as defined in section 2A-11.

2F-38 Weigh Station

Weigh station signing on freeways shall be the same as that specified in section 2D-45, except for lettering size and the advance posting distance for the Exit Direction sign, which shall be located 1500 feet in advance of the gore. The recommended sign layout for freeway applications are shown in Standard Highway Signs.*

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* Available from GPO, see page ii.

2F-39 Milepost Markers

Milepost signs shall be placed on all freeway facilities and shall conform to the general provisions for mileposts contained in section 2D-47. Markers shall contain 10-inch white numerals on 12-inch wide vertical green panels with a white border. Panels shall be 24, 36, or 48 inches in length for one, two, or three digits, respectively, and contain the word MILE. Milepost markers may be placed up to 30 feet from the edge of the pavement. Milepost markers located in line with delineator posts shall have the bottom of the marker at the same height as the delineator. The distance numbering shall be continuous for each route within any State except where overlaps occur. With overlapped routes, continuity shall be established for one of the routes which should also have continuity in the interchange exit numbering (sec. 2F-19). On the route without milepost continuity, the first marker beyond the overlap should be such as to indicate the total distance traveled on the route so that a motorist may have a means of coorelating his travel distance between mileposts with that shown on his odometer.

2F-40 Route Markers and Trailblazers (figs. 2-45, 2-46)

As in the case of expressways (sec. 2E-20), route markers on freeways will ordinarily be incorporated as shields or other distinctive shapes into large directional guide signs. The use of independent markers on freeways will be limited primarily to route confirmation assemblies as shown in figures 2-36, 2-37, and 2-40.

The official route marker for the Interstate Highway System is the red, white and blue reflectorized distinctive shield adopted by AASHTO on August 14, 1957. Where the Interstate shield is displayed in an assembly or on the face of a guide sign with U.S. or State route markers, the Interstate numeral should be at least equal in size to these other route markers. The Interstate shield shall be fully reflectorized and shall conform to the standards set forth in Standard Highway Signs.*

The standard trailblazer assembly (sec. 2D-33) will usually have application on roads leading to a freeway. Where there are gaps between completed sections of a freeway route, the trailblazer assembly should be used to indicate the best routing between the termini of the completed sections.

The commonly used name or trailblazer symbol for a toll facility may be displayed on free sections of the Interstate System at:

1. The last exit before entering a toll section of the Interstate System;
2. The interchange or connection with a toll facility, whether or not the toll facility is a part of the Interstate System; and
3. Other locations within a reasonable approach distance of toll facilities when the name or trailblazer symbol for the toll facility would

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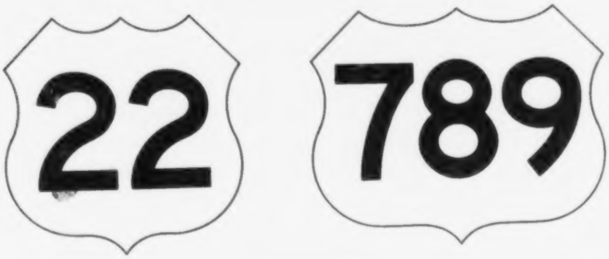
* Available from GPO, see page ii.

FOR GUIDE SIGN USE



FOR INDEPENDENT USE

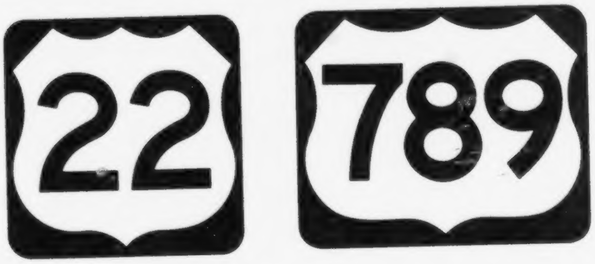


Figure 2–45. Typical shields.

FOR GUIDE SIGN AND INDEPENDENT USE

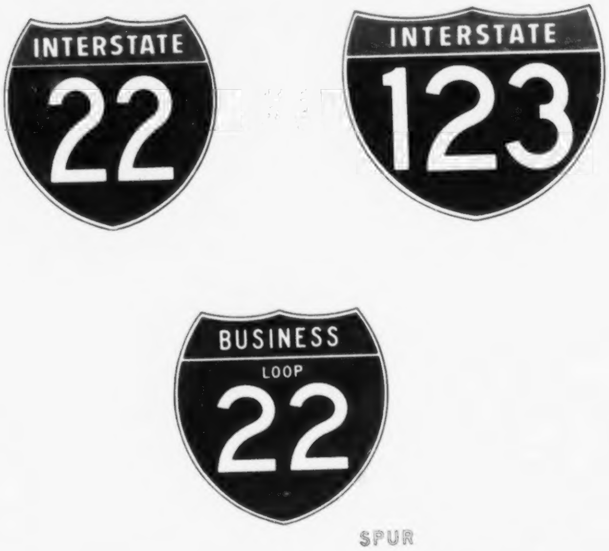

INTERSTATE
22
INTERSTATE
123
BUSINESS
LOOP
22
SPUR

Figure 2–46. Interstate Shields and Off-Interstate markers.

provide better guidance to drivers unfamiliar with the area than would place names and route numbers.

The toll facility name or marker may be included as a part of the guide sign installations on intersecting highways and approach roads to indicate the interchange with a toll section of an Interstate highway. Where needed for the proper direction of traffic, a trailblazer for a toll facility that is part of the Interstate System may be displayed with the Interstate trailblazer assembly.

2F-41 Miscellaneous Freeway Guide Signs

Certain other guide signs, in addition to those previously discussed, may be used on freeways if they do not interfere with signing for interchanges or other critical points. These include the types described in sections 2E-39 and 42.

Supplemental guide signs with a white legend and border on a brown background may be used when a park or recreational area is being signed as a significant destination for users of the Interstate and other freeway systems. The same color combination can be used for advance guide and exit direction signs for an interchange where the crossroad leads exclusively to a park or recreational area.

Where the crossroad is a numbered route or leads to other destinations, the advance guide and exit direction signs shall retain the white on green color combination. All gore signs shall remain with a white legend on a green background. The background color of interchange exit number panels shall match the color of the guide sign proper.

2F-42 Signing on Freeway Approaches

Freeway signing standards may have to be extended to the approach roads for some of the major interchanges. Frontage roads need not be signed to freeway standards, but otherwise should be consistent with requirements for roadways of their particular class.

PART—G
Motorist Service Signing

PART II-B

[illegible]

[illegible]

2G-5 SPECIFIC SERVICE SIGNING

2G-5.1 Application of Specific Service Signs

Specific service signs provide travelers with business identification and directional information for essential motorist services. The signs may be used on any class of highway and are intended for use primarily in areas rural in character. The use of specific service signs should be based on a determination of motorist need for this type of signing.

Specific service signs, if used, shall carry word legends for one or more of the following services, GAS, FOOD, LODGING, OR CAMPING, along with an appropriate directional legend such as NEXT RIGHT, SECOND RIGHT or directional arrows, the exit number where applicable, and one or more separately attached business logos. The signs shall have white reflectorized uppercase letters, numbers, arrows, and borders on a blue background. The signs may be illuminated. Typical specific service signs are shown in Figure 2-47.

The number of signs shall be limited to one for each type of service along an approach to an interchange or intersection. The number of logos permitted on a sign is specified in Sections 2G-5.5 and 2G-5.6.

In the direction of traffic, successive specific service signs shall be those of CAMPING, LODGING, FOOD, and GAS in that order. The signs should be located so as to take advantage of natural terrain, to have the least impact on the scenic environment, and to avoid visual conflict with other signs within the highway right-of-way. Unprotected sign supports located within the clear zone shall be of a breakaway type of design. Typical sign locations are shown in Figure 2-48.

2G-5.2 LOGOS

A business logo, which may consist of the business identification symbol, name, brand, trademark, or combination, shall be shown on a separate panel which is attached to the specific service sign. Logos shall have a blue background with a white legend and border. The principle legend should be at least equal in height to the directional legend on the sign. Where business identification symbols or trademarks are used alone for a logo, the border may be omitted, the symbol or trademark shall be reproduce in the colors and general shape consistent with customary use, and any integral legend shall be in proportionate size.

Messages, symbols, and trademarks which resemble any official traffic control device shall not be used.

2G-5.3 Size of Logos and Signs

Each logo, including its border, when attached to a specific service sign, shall be contained within a rectangular background area which shall not exceed the dimensions shown in Table II-4 for the applicable class of highway and location. Category 1 sizes are for use on expressways where access to crossroads is provided by at-grade intersections. Category 2 sizes are intended as alternates for signing at-grade intersections located between interchanges on expressways. Category 2 sizes shall be used only in conformance with the State signing policy specified in Section 2G-5.8.

Table II-4 Logo Sizes

	GAS		*FOOD LODGING*	*CAMPING*
Class of Highway	*Width*	*Height*	*Width*	*Height*
Freeway (Section 2F-1)	48″	36″	60″	36″
Expressways (Section 2E-1)				
Interchanges	48″	36″	60″	36″
Intersections—Category 1	36″	24″	36″	24″
Intersections—Category 2	48″	36″	60″	36″
Conventional Roads	24″	18″	24″	18″

Sign sizes must be fixed primarily in terms of the amount and height of legend and the number and size of logos attached to the sign. The vertical and horizontal spacing between logos shall not exceed 8 inches and 12 inches, respectively. Reference shall be made to Sections 2A-19, 2E-12, and 2F-12 for information on borders and on interline and edge spacing.

2G-5.4 Size of Lettering

All letters and numerals on specific service signs, other than on the logos, shall conform to the sizes specified in Table II-5. Letter sizes specified for Expressway Intersections, Category 2, shall be used only in

Table II-5—Letter and Numeral Sizes for Specific Service Signs

	Freeways	*Expressways*			*Ramps and Conventional Highways*
		Interchanges	*Intersections*		
			Category 1	*Category 2*	
Services	10″	10″	6″	10″	4″
Action Message	10″	10″	6″	10″	4″
Exit Legends					
Words	10″	10″			
Numeral	10″	10″			
Letter	10″	10″			

conjunction with Category 2 logo sizes given in Table II-4. Arrow details are provided in the publication "Standard Highway Signs." *

2G-5.5 Signing at Interchanges

When used on freeways or at interchanges on expressways, a separate specific service sign shall be used for each type of service for which logos are displayed. Exceptions may be made at remote rural intersections. The specific service signs shall be erected between the previous interchange and 800 feet in advance of the exit direction sign at the interchange from which the services are available. There should be at least 800 feet spacing between the signs. Excessive spacing is not desirable. Specific service signs should not be erected at an interchange where the motorist cannot conveniently reenter the freeway or expressway and continue in the same direction of travel.

At single-exit interchanges, the name of the type of service followed by the exit number shall be displayed on one line above the logos. At unnumbered interchanges, the directional legend NEXT RIGHT (LEFT) shall be substituted for the exit number. The GAS specific service sign shall be limited to six logos; the FOOD, LODGING, and CAMPING specific service signs shall be limited to four logos each.

At double-exit interchanges, the specific service signs shall consist of two sections, one for each exit. The top section shall display the logos for the first exit and the lower section shall display the logos for the second exit. The name of the type of service followed by the exit number shall be displayed in a line above the logos in each section. At unnumbered interchanges, the legends NEXT RIGHT (LEFT) and SECOND RIGHT (LEFT) shall be substituted for the exit numbers. Where a type of motorist service is to be signed for at only one exit, one section of the specific service sign may be omitted, or a single-exit interchange sign may be used. The number of logos on the sign (total of both sections) shall be limited to six for GAS and four each for FOOD, LODGING, and CAMPING.

In remote rural areas, where not more than two qualified facilities are available for each of two or more types of services, logos for two types of services may be displayed on the same sign. Not more than two logos for each type of service shall be displayed in combination on a sign. The name of each type of service shall be displayed above its respective logo(s), and the exit number shall be displayed above the names of the types of services. At unnumbered interchanges, the legend NEXT RIGHT (LEFT) shall be substituted for the exit number. Logos should not be combined on a sign when it is anticipated that additional service will become available in the near future. When it becomes necessary to display a third logo for a type of service displayed in combination, the logos involved shall then be displayed as required at single- or double-exit interchanges.

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* Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Exit ramp signs shall be installed at single-exit interchanges along the ramp or at the ramp terminal for service facilities which have specific service signs along the main roadway, but are not visible from the ramp terminal. Ramp signs for visible facilities may be omitted. Ramp signs shall be duplicates of the corresponding specific service signs along the main roadway, but reduced in size. They may be installed along the crossroad. The signs should include the distances to the service installations. Directions shall be indicated by arrows. The minimum letter height should conform to Table II-5, except that any legend on a symbol shall be proportional to the size of the symbol. Ramp signing may be used on ramps and crossroads at double-exit interchanges.

2G-5.6 Signing at Intersections

When specific service signs are used on conventional roads and at intersections on expressways, they should be erected between the previous interchange or intersection and 300 feet in advance of the intersection from which the services are available. The spacing between signs should be determined on the basis of an engineering study. Signs similar to exit ramp signs may be provided on the crossroad. Logos should not be displayed for a type of service for which a qualified facility is visible from a point on the traveled way 300 feet from the intersection.

Each specific service sign should be limited to four logos. Not more than four logos for each type of service should be displayed along each approach to the intersection. A maximum of two logos for each two different types of services may be combined on the same sign. The name of each type of service shall be displayed above its logo(s), together with an appropriate legend such as NEXT RIGHT (LEFT) or a directional arrow.

2G-5.7 Guidelines for Specific Service Signing

Use of specific service signing should conform to the following guidelines:

1. Eligible service facilities shall comply with laws concerning the provisions of public accommodations without regard to race, religion, color, age, sex, or national origin, and laws concerning the licensing and approval of service facilities.

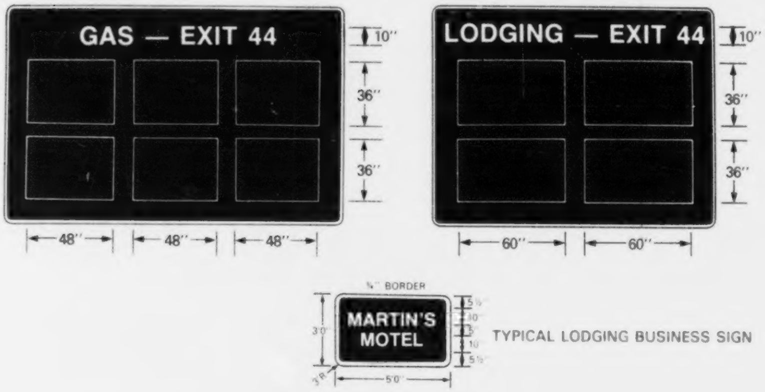
2. Distances to eligible services should not exceed 3 miles in either direction, except that, if within the 3 miles limit, services of the type being considered are not available, the limit of eligibility may be extended in 3 mile increments until one or more services of the type being considered, or 15 miles, whichever comes first, are reached.

3. The use of GAS signs including:
   (1) vehicle services including fuel, oil, tire repair, and water;
   (2) restroom facilities and drinking water;

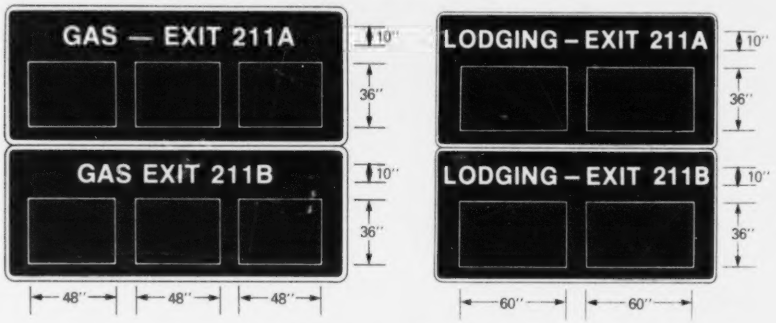
(3) continuous operation at least 16 hours per day, 7 days per week, for freeways and expressways, and continuous operation at least 12 hours per day, 7 days per week, for conventional roads; and

(4) telephone.

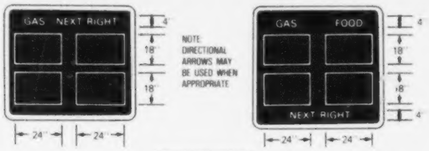
4. The use of FOOD signs including continuous operations to serve three meals a day, 7 days a week and a telephone.


GAS — EXIT 44
10"
36"
36"
48"
48"
48"
LODGING — EXIT 44
10"
36"
36"
60"
60"
¼" BORDER
MARTIN'S
MOTEL
3'0"
5½"
10"
5"
10"
5½"
3"R
5'0"
TYPICAL LODGING BUSINESS SIGN

SINGLE EXIT INTERCHANGE


GAS — EXIT 211A
10"
36"
GAS EXIT 211B
10"
36"
48"
48"
48"
LODGING – EXIT 211A
10"
36"
LODGING – EXIT 211B
10"
36"
60"
60"

DOUBLE EXIT INTERCHANGE


GAS NEXT RIGHT
4"
18"
18"
24"
24"
GAS
FOOD
NEXT RIGHT
4"
18"
18"
4"
24"
24"

NOTE
DIRECTIONAL
ARROWS MAY
BE USED WHEN
APPROPRIATE

INTERSECTION

Figure 2-47. Typical Specific Service Signs

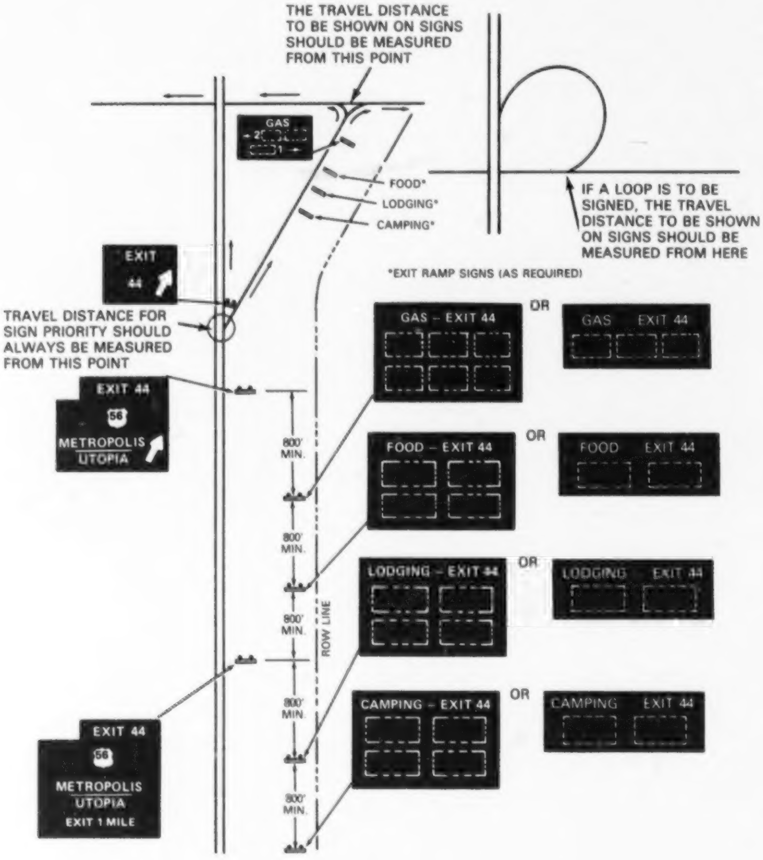

THE TRAVEL DISTANCE TO BE SHOWN ON SIGNS SHOULD BE MEASURED FROM THIS POINT
GAS
2
1
FOOD*
LODGING*
CAMPING*
IF A LOOP IS TO BE SIGNED, THE TRAVEL DISTANCE TO BE SHOWN ON SIGNS SHOULD BE MEASURED FROM HERE
EXIT
44
*EXIT RAMP SIGNS (AS REQUIRED)
TRAVEL DISTANCE FOR SIGN PRIORITY SHOULD ALWAYS BE MEASURED FROM THIS POINT
EXIT 44
56
METROPOLIS
UTOPIA
GAS – EXIT 44
OR
GAS EXIT 44
800' MIN.
FOOD – EXIT 44
OR
FOOD EXIT 44
800' MIN.
LODGING – EXIT 44
OR
LODGING EXIT 44
800' MIN.
ROW LINE
800' MIN.
CAMPING – EXIT 44
OR
CAMPING EXIT 44
EXIT 44
56
METROPOLIS
UTOPIA
EXIT 1 MILE
800' MIN.

Figure 2-48. Typical Signing for Interchanges

5. The use of LODGING signs including adequate sleeping accommodations, and a telephone.

6. The use of CAMPING signs including adequate parking accommodations, modern sanitary facilities, and drinking water.

2G-5.8 Signing Policy

Each agency with highway jurisdiction that elects to use specific service signs should establish a signing policy which includes, as a minimum, the Provisions of Section 2G-5.7 and the following criteria:

1. Selection of eligible businesses.
2. Distances to eligible services.

3. The use of logos and legends conforming to the requirements of Tables II-4 and II-5.

4. Removal or covering of logos during off seasons for business operating on a seasonal basis.

5. The circumstances, if any, in which specific service signs may be used outside rural areas.

6. Determination of the costs to businesses for initial permits, installations, annual maintenance, removal, etc., of logos.

PART II—J
Signing for Civil Defense

J. SIGNING FOR CIVIL DEFENSE

II-1(c)
Rev. 4

2J-1 Civil Defense Emergencies

Advance planning of local action in response to warning of an attack is the responsibility of State and local authorities. The Federal Government will provide guidance to the States as necessitated by changing circumstances. Civil defense signing is a tool of contingency planning. It is not possible to be sure in advance that any hazardous conditions will, or will not occur at any given place. First emphasis must be given to planning the use of the best shelter available at any time. The fallout shelter is the core of civil defense.

Mass evacuation is not a fruitful planning contingency by itself. Evacuation planning without shelter planning is self-defeating. Signing for preattack evacuation to distant shelters may be thought desirable as an alternative for some communities. Contingency planning for postattack evacuation is desirable for all communities. Plans have been developed for the control of highway traffic under emergency conditions such as could result from accidental disaster or enemy attack. Particularly these plans are concerned with possibilities of nuclear warfare.

In the event of disaster there will be a closing of highways that cannot be used, a controlled operation of certain designated highways, the establishing of regulation posts for the expediting of essential traffic, and the provision of emergency centers for civilian aid.

To guide and control highway traffic in an emergency, special highway signs will be needed. The signs here specified have been approved and are here prescribed as standard for use when and where applicable in the civil defense program.

These emergency signs will not permanently displace any of the standard signs that are normally applicable, and as conditions permit they should be replaced or augmented by standard signs.

The nature, scope and operation of emergency highway traffic regulation in time of emergency brought about by an enemy nuclear attack are discussed in "A Guide for Highway Traffic Regulation in an Emergency" available from the Federal Highway Administration (HTO-33), Washington, D.C. 20590.

2J-2 Design of Civil Defense Signs

II-1(c)
Rev. 4

For economy in stockpiling and in emergency fabrication, all the special civil defense signs, with the exception of the Evacuation Route Marker, are designed for a single size of plate measuring 24 by 30 inches, and have a black legend and border on a white background. The background should be reflectorized.

In an emergency these signs may be needed in large numbers and are for essentially temporary use. Consideration should accordingly be given to their fabrication from any light and economical material that can serve through the emergency period.

Any of these signs may be accompanied by a standard triangular marker for marking areas contaminated by biological and chemical warfare agents and radioactive fallout.

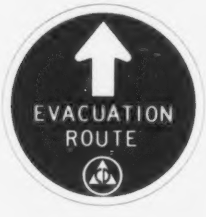
Signs such as "In Case of Enemy Attack this Highway Will be Closed" or "Civil Defense Highway" or "Emergency Route for Civil Defense" shall not be used.

2J-3 Evacuation Route Marker (CD-1)

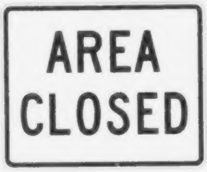
II-1(c)
Rev. 4

The Evacuation Route Marker shall be circular, having a minimum outside diameter of 18 inches, carrying a directional arrow and the legend EVACUATION ROUTE. The standard Civil Defense Symbol, CD inscribed in a triangle within a ring, shall appear near the bottom of the sign, with a diameter of 3 ½ inches. The legend, arrow, symbol, and border shall be in white on a blue background. At least the arrow and border shall be reflectorized. The arrow designs shall include a straight vertical arrow pointing upward, a straight horizontal arrow pointing to left or right, and a bent arrow pointing to left or right for advance warning of a turn. The arrow may be a separate unit attached to the face of the sign. The marker format may also be used on a nonreflectorized, white, square plate.

The Evacuation Route Marker, with the appropriate arrow, shall be erected 150 to 300 feet in advance of, and at, any turn in an approved evacuation route, and elsewhere for straight-ahead confirmation where needed. In urban areas it shall be mounted at the right of the roadway, not less than 7 feet above the top of the curb, and at least 1 foot back from the face of the curb. In rural areas it shall be not less than 5 feet above the crown of the roadway and 6 to 10 feet to the right of the roadway edge.



CD–1
18" diameter (blue)



CD–2
30" x 24"

Evacuation Route Markers shall not be placed where they will conflict with normal signs. Where conflict in placement would occur between the Evacuation Route Marker and a standard regulatory sign, the latter shall take precedence. In case of conflict with a standard informational sign the civil defense sign may take precedence.

Placement of Evacuation Route Markers should be made under the supervision of the officials having jurisdiction over the placement of normal traffic signs, but coordination with Civil Defense authorities and agreement between contiguous political entities will be necessary to assure continuity of routes.

2J-4 Area Closed Sign (CD-2)

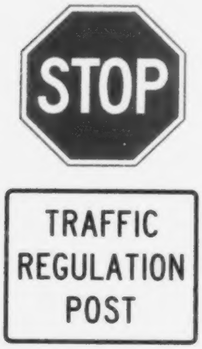
II-1(c)
Rev. 4

The AREA CLOSED sign shall be used to close a roadway entering an area from which all traffic is excluded because of dangerous radiological or biological contamination. It shall be erected on the shoulder as near as practicable to the right-hand edge of the roadway, or preferably on a portable mounting or barricade partly or wholly in the roadway. For best visibility, particularly at night, its height should not normally exceed 4 feet from the pavement to the bottom of the sign. Unless adequate advance warning signs are used, it should not be so placed as to create a complete and unavoidable blockade. Where feasible, the sign should be located at an intersection that provides a detour route.

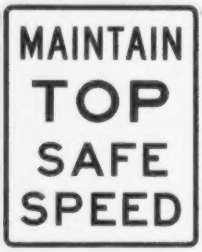
2J-5 Traffic Regulation Post Sign (CD-3)

II-1(c)
Rev. 4

The STOP-TRAFFIC REGULATION POST sign shall be used to designate a point where an official post has been set up to impose such controls as are necessary to limit congestion, expedite emergency traffic,



CD-3
30" x 30"
30" x 24"



CD-4
24" x 30"

exclude unauthorized vehicles, or protect the public. It shall be erected in the same manner as the Area Closed sign (sec. 2G-4) at the point where traffic must stop to be checked.

The standard R-1 STOP sign shall be used for this mandatory stop restriction. The supplemental panel TRAFFIC REGULATION POST should be mounted directly below the STOP sign and shall consist of a black legend on a reflectorized white background.

2J-6 Emergency Speed Sign (CD-4)

II-1(c
Rev. 4

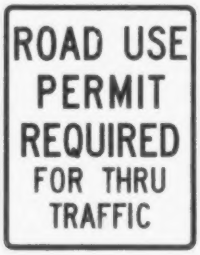
The MAINTAIN TOP SAFE SPEED sign may be used on highways where radiological contamination is such as to limit the permissible exposure time for occupants of vehicles passing through the area. Since any speed zoning would be impractical under such emergency conditions, no minimum speed limit can be prescribed by the sign in numerical terms. Where traffic is supervised by a traffic regulation post, official instructions will usually be given verbally, and the sign will serve as an occasional reminder of the urgent need for all reasonable speed.

The sign should be erected at random intervals as needed, in the same manner as other standard speed signs. In rural areas it shall be mounted on the right-hand side of the road with its lower edge not less than 5 feet above the crown of the roadway, 6 to 10 feet from the roadway edge. In urban areas the height shall be not less than 7 feet, and the nearest edge of the sign shall be not less than 1 foot back from the face of the curb. Where an existing Speed Limit sign is in a suitable location, the Top Safe Speed sign may conveniently be mounted directly over the face of the older sign, which it supersedes.

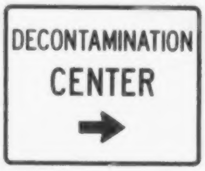
2J-7 Road Use Permit Sign (CD-5)

II-1(c)
Rev. 4

The ROAD USE PERMIT REQUIRED FOR THRU TRAFFIC sign is to be used at an intersection, at the entrance to a route on which a traffic regulation post is located. Its intent is to notify drivers of the presence of



CD-5
24" x 30"



CD-6
30" x 24"

the post so that those who do not have priority permits issued by designated authorities can detour on another route, or turn back, without making a needless trip and without adding to the screening load at the post. Local traffic, without permits, may proceed as far as the regulation post. The sign shall be erected in a manner similar to that of the Emergency Speed sign (sec. 2G-6).

2J-8 Emergency Aid Centers Sign (CD-6)

II-1(c)
Rev. 4

In the event of emergency, State and local authorities will establish various centers for civilian relief, communication, medical service, and similar purposes. To guide the public to such centers a series of directional signs will be needed. These signs shall carry the designation of the center and an arrow indicating the direction to the center. They shall be erected as needed, at intersections and elsewhere, on the right-hand side of the roadway, at a height in urban areas of at least 7 feet, and not less than 1 foot back from the face of the curb, and in rural areas at a height of 5 feet, 6 to 10 feet from the roadway edge.

These signs shall carry one of the following legends, as appropriate, or others designating similar emergency facilities:

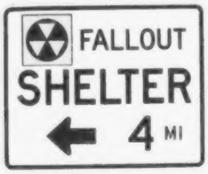
DECONTAMINATION CENTER
REGISTRATION CENTER
WELFARE CENTER
MEDICAL CENTER

2J-9 Fallout Shelter Directional Sign (CD-7)

II-1(c)
Rev. 4

The Fallout Shelter directional sign shall be used to direct the public to selected fallout shelters that have been licensed and marked for emergency use. They may be erected on all highways, except those on the Interstate System, when it has been determined that a need exists for such signs upon completion of an approved community shelter planning study.

These guide signs may be used to direct people to fallout shelters in rural areas and the environs of a metropolitan area where shelters have a larger capacity than is required to accommodate the local inhabitants of the surrounding area. The signs may be used to identify different routes to a



CD-7
30" x 24"

shelter to provide for rapid movement of large numbers of persons, but as a general rule should not be posted more than five miles from the shelter.

The fallout shelter directional sign should be used sparingly and only in conjunction with approved plans of State and local civil defense directors. The erection of these signs shall conform to established highway signing standards. Where used, the signs shall not be erected in competition with other necessary highway guide and regulatory signs.

The fallout shelter directional sign is a horizontal rectangle, 30 by 24 inches, containing the identifying "public fallout shelter" emblem in the upper left part of the sign. The colors of the emblem are yellow triangles inscribed in a black circle placed on a yellow square. The words "FALLOUT SHELTER"—the directional arrow, the distance to shelter (which can be omitted when appropriate), and the border are in black against a white background.

PART III
Markings

PART III. MARKINGS

A. GENERAL PRINCIPLES

3A-1 Functions and Limitations

Markings have definite and important functions to perform in a proper scheme of traffic control. In some cases, they are used to supplement the regulations or warnings of other devices such as traffic signs or signals. In other instances, they are used alone and produce results that cannot be obtained by the use of any other device. In such cases they serve as a very effective means of conveying certain regulations and warnings that could not otherwise be made clearly understandable.

Pavement markings have definite limitations. They are obliterated by snow, may not be clearly visible when wet, and may not be very durable when subjected to heavy traffic. In spite of these limitations, they have the advantage, under favorable conditions, of conveying warnings or information to the driver without diverting his attention from the roadway.

3A-2 Standardization of Application

Each standard marking shall be used only to convey the meaning prescribed for it in this Manual. Before any new highway, surfaced detour, or temporary route is opened to traffic, all necessary markings should be in place.

Markings no longer applicable which may create confusion in the mind of the motorist shall be removed or obliterated as soon as practicable. Other markings required by road conditions or restrictions should be removed or obliterated when those conditions cease to exist or the restrictions are withdrawn. Markings which must be visible at night shall be reflectorized unless ambient illumination assures adequate visibility. All markings on Interstate highways shall be reflectorized.

Of growing importance is the tendency of traffic authorities to accommodate variable traffic conditions with different types of operation. For this purpose, signs and signals with the ability to display variable messages have been developed. The use of variable messages in the field of markings, however, has been somewhat more limited and confined to the manual placement of flexible cones and posts, and to a few mechanically-operated devices. It is to be expected that the future will bring forth new, practical methods of conveying variable messages by means of markings. When such need and opportunity occur, extreme care should be used to adhere to the principles set forth in this Manual.

3A-3 Materials

The most common method of placing pavement, curb, and object markings is by means of paint; however, a wide variety of other suitable marking materials including raised pavement markers is available. Materials used should provide the specified color throughout their useful life.

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Marking material used in the vicinity of pedestrian activity should not present tripping or excessive slipping hazards.

3A-4 Colors

Pavement markings shall be yellow, white, or red in color.

The use of black is permitted in combination with the above colors where the pavement itself does not provide sufficient contrast. This use of black does not establish it as a standard pavement marking color but only as a means of achieving contrast on light-colored pavements.

The colors for pavement marking shall conform to the standard highway colors.

3A-5 General Principles-Longitudinal Pavement Markings

Longitudinal pavement markings shall conform to the following basic concepts:

1. Yellow lines delineate the separation of traffic flows in opposing directions or mark the left edge of the pavement of divided highways and one-way roads.
2. White lines delineate the separation of traffic flows in the same direction or mark the right edge of the pavement.
3. Red markings delineate roadways that shall not be entered or used by the viewer of those markings.
4. Broken lines are permissive in character.
5. Solid lines are restrictive in character.
6. Width of line indicates the degree of emphasis.
7. Double lines indicate maximum restrictions.
8. Markings which must be visible at night shall be reflectorized unless ambient illumination assures adequate visibility.
9. Raised pavement markers may serve as position guides for, may supplement, or in some cases may be substituted for other types of markings.

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3A-6 Widths and Patterns of Longitudinal Lines

The widths and patterns of longitudinal lines shall be as follows:

1. A normal width line is 4" to 6" wide.
2. A wide line is at least twice the width of a normal line.
3. A double line consists of two normal width lines separated by a discernible space.

4. A broken line is formed by segments and gaps, usually in the ratio of 1:3. On rural highways, a recommended standard is 10 foot segments and 30 foot gaps. Other dimensions in this ratio may be used as best suit traffic speeds and need for delineation.

5. A dotted line is formed by short segments, normally two feet in length, and gaps, normally four feet or longer.

3A-7 Types of Longitudinal Lines

The following examples illustrate the application of the principles and standards set forth in sections 3A-4 to 3A-6:

1. A normal, broken white line is used to delineate the edge of a travel path where travel is permitted in the same direction on both sides of the line. Its most frequent application is as a lane line of a multi-lane roadway.

2. A normal, broken yellow line is used to delineate the left edge of a travel path where travel on the other side of the line is in the opposite direction. A frequent application is as a center line of a two-lane, two-way roadway where overtaking and passing is permitted.

3. A normal, solid white line is used to delineate the edge of a travel path where travel in the same direction is permitted on both sides of the line but crossing the line is discouraged and to mark the right edge of the pavement. A frequent application is as a lane line approaching an intersection. A wide solid white line is used for emphasis where the crossing requires unusual care. It is frequently used as a line to delineate left or right turn lanes.

4. A double solid white line is used to delineate a travel path where travel in the same direction is permitted on both sides of the line, but crossing the line is prohibited. It is frequently used as a channelizing line in advance of obstructions which may be passed on either side but not encroached upon.

5. A double line consisting of a normal, broken yellow line and a normal, solid yellow line delineates a separation between travel paths in opposite directions where overtaking and passing is permitted with care for traffic adjacent to the broken line and is prohibited for traffic adjacent to the solid line. This is a one direction, no-passing marking. It is used on two-way, two- and three-lane roadways to regulate passing. It is also used to delineate the edges of a lane in which travel in either direction is permitted (but only as part of a left turn maneuver). In the latter application, the markings are to be placed with the solid lines on the outside and the dashed lines to the inside of the lane. Traffic adjacent to the solid line may cross this marking with care only as part of a left-turn maneuver.

6. A double line consisting of two normal solid yellow lines delineates the separation between travel paths in opposite directions where overtaking and passing is prohibited in both directions. This is a two-

direction, no-passing marking. Crossing this marking with care is permitted only as part of a left-turn maneuver. It is frequently used as a channelizing line in advance of an obstruction which must be passed on the right and to form a channelizing island separating traffic in counter directions.

7. A double, normal, broken yellow line delineates the edge of a lane in which the direction of travel is changed from time to time in such a way that the line serves as the centerline of the roadway during some period. Its use is for a reversible lane.

8. A normal dotted line is used to delineate the extension of a line through an intersection or interchange area. It shall be the same color as the line it extends.

9. A solid yellow line delineates the left edge of a travel path to indicate a restriction against passing on the left or delineates the left edge of each roadway of divided streets or highways, one-way roadways, and ramps in the direction of travel.

3A-8 Transverse Markings

Transverse markings, which include shoulder markings, word and symbol markings, stop lines, crosswalk lines, speed measurement markings, parking space markings and others shall be white except that:

1. Transverse median markings shall be yellow (sec. 3B-10).

2. Markings visible only to traffic proceeding in the wrong direction on a one-way roadway may be red

Because of the low approach angle at which pavement markings are viewed, it is necessary that transverse lines be proportioned to give visibility equal to that of longitudinal lines. Pavement marking letters, numerals, and symbols shall be in accordance with the Standard Alphabets for Highway Signs and Pavement Markings.*

3A-9 Curb Markings

Curb markings fall into two categories: roadway delineation (sec. 3D-3) and parking regulations (sec. 3B-21). III-9(c) Rev. 4

3A-10 Raised Pavement Markers, Reflectorized and Non-Reflectorized

Raised pavement markers may be used as positioning guides, or to supplement, or in some cases to substitute for other types of markings. The color of raised pavement markers shall conform to the color of the marking for which they serve as a positioning guide, or for which they supplement, or substitute. III-9(c) Rev. 4

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*Available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590.

Retroflective raised pavement markers are generally preferable for most applications. Non-retroflective raised pavement markers should not be used alone, without supplemental retroflective markers, as a substitute for other types of pavement markings.

Retroreflectorized raised pavement markers normally are available in mono-directional and bi-directional configurations with white and yellow retroflective elements. Other colors, and combinations of colors may be used for special purposes. Use should be made of the mono- and bi-directional characteristics available to maximize the information given to the motorist, to minimize wrong information and to avoid confusion resulting from visibility of markers which do not apply to the motorist.

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The spacing of raised pavement markers used to supplement or substitute for other types of longitudinal markings should be chosen in relationship to the pattern of broken lines being supplemented or substituted for, using a value of "N" equal to the length of one line segment plus one gap.

Applications of raised pavement markers are described in Sec. 3B-14, 3B-15 and 3B-16. These applications are not intended to preclude the use of metallic markers or inserts, less than 1" high with no other coloring or retroreflectorization on the pavement when installed primarily to aid in repainting or installation of other types of markings. Such devices are not classified as raised pavement markers.

B. APPLICATIONS OF PAVEMENT AND CURB MARKINGS

3B-1 Center Lines

A center line separates traffic traveling in opposite directions. It need not be at the geometrical center of the pavement. Centerlines provide important guidance to motorists and should be used on most paved roads. On roads where a continuous centerline is not used, short sections may be used to control the position of traffic at specific locations, such as around curves, over hills, and on approaches to intersections, railroad crossings, and bridges.

The center line markings on two-lane, two-way highways shall be either:

1. a normal, broken yellow line where passing is permitted (#2, sec. 3A-7), or

2. a double line consisting of a normal broken yellow line and a normal, solid yellow line where passing is permitted in one direction (#5, sec. 3A-7), or

3. a double line consisting of two normal solid yellow lines where passing is prohibited in both directions (#6, sec. 3A-7).

The center line on undivided highways where four or more lanes are always available, is usually a double solid yellow line.

On three-lane rural highways, two lanes should be designated for traffic in one direction and marked as illustrated in figures 3-2a and 3-2b (page 3B-3).

Center lines are recommended on paved highways under the following conditions:

1. In rural districts on two-lane pavements 16′ or more in width with prevailing speeds of greater than 35 MPH.

2. In residence or business districts on all through highways, and on other highways where there are significant traffic volumes.

3. On all undivided pavements of four or more lanes.

4. At other locations where an engineering study indicates a need for them.

Applications of center lines are shown in various illustrations herein, particularly figures 3-1, 3-2, 3-3, 3-4, and 3-5.

3B-2 Lane Lines

Lane lines separate lanes of traffic traveling in the same direction. They shall be used on all Interstate highways, and should be used:

1. On all other multi-lane highways.

2. At congested locations where the roadway will accommodate more lanes of traffic than would be the case without the use of lane lines.

Lane lines are usually normal broken white lines which permit lane changing with care.

A normal solid white line may be used as the lane line in critical areas where it is advisable to discourage lane changing. Typical locations for such applications are tunnels or bridges having width restrictions and interchange areas where lane changing disrupts traffic flow.

A solid white line may be used to separate through-traffic lanes from special secondary lanes, such as uphill truck lanes, left-or right-turn lanes and transit bus lanes.

A double solid white line shall be used when lane changing is prohibited.

Applications of lane lines are illustrated in figures 3-1, 3-2, 3-4, 3-5, and 3-6.

3B-3 No-Passing Zone Markings

Where center lines are installed, no-passing zones shall be established at vertical and horizontal curves and elsewhere on two- and three-lane highways where an engineering study indicates passing must be prohibited because of inadequate sight distances or other special conditions. Specific reference is made to section 11-307 UVC Revised 1968.

A no-passing zone shall be marked by either a one direction, no-passing marking (#5, sec. 3A-7) or a two direction, no-passing marking (#6, sec. 3A-7) as illustrated in figure 3-2b.

3B-4 Application of No-Passing Zone Markings

On a two-or three-lane highway, the no-passing marking shall be parallel to and extended along the center line throughout the no-passing zone.

On a three-lane highway where the single lane is being moved from one side of the road to the opposite side, a no-passing buffer zone shall be provided by transitioning the centerline markings diagonally across the center lane to the beginning of the no-passing buffer zone, and thence along this location to the end of the buffer zone (fig. 3-7a). An alternate method of marking this condition is illustrated in figure 3-7b. The markings shall extend across the center lane on a diagonal for a distance (taper length) computed by the formula $L = WS$ for all roadways having a posted speed of 45 m.p.h. or greater. For urban, residential, and other streets having posted speeds of 40 m.p.h. or less, taper length should be computed by the formula $L = WS^2/60$. Under both formulas, L equals the taper length in feet, W the width of the center lane in feet, and S the off-peak 85 percentile speed in miles per hour.

Typical two-way marking with a reversible center lane.

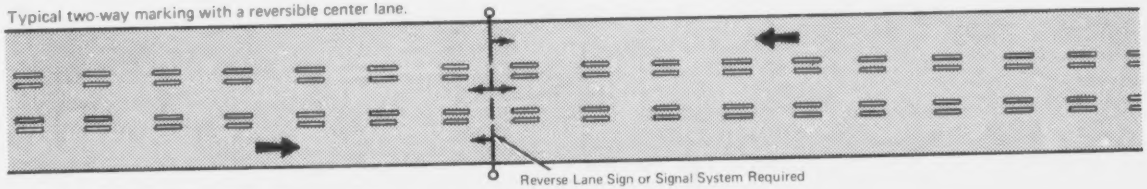
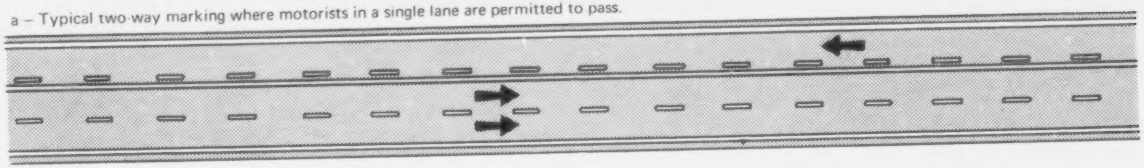

Reverse Lane Sign or Signal System Required

Figure 3-1. Typical reversible lane marking application.

a – Typical two-way marking where motorists in a single lane are permitted to pass.



b – Typical two-way marking where motorists in a single lane are not permitted to pass.

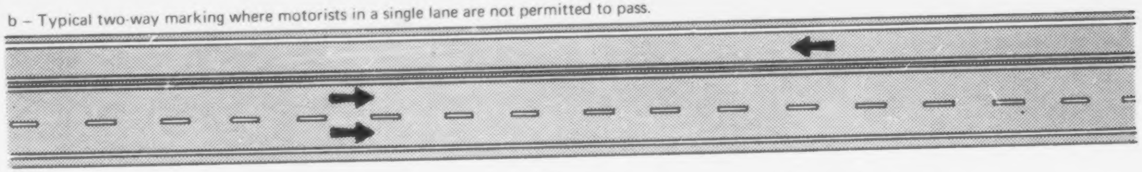
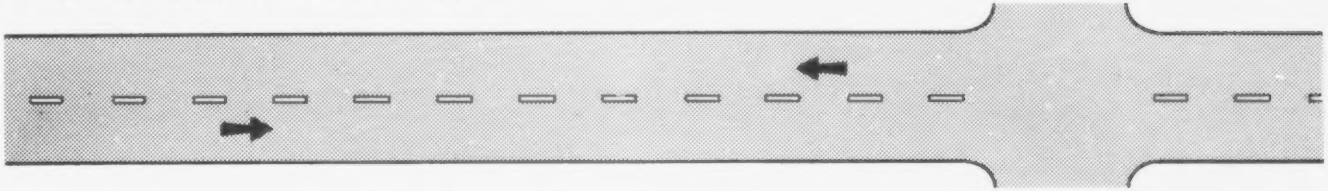


Figure 3-2. Typical 3-lane, two-way marking applications.

a – Typical two-lane, two-way marking with passing permitted.



b – Typical two-lane, two-way marking with passing prohibited zones.

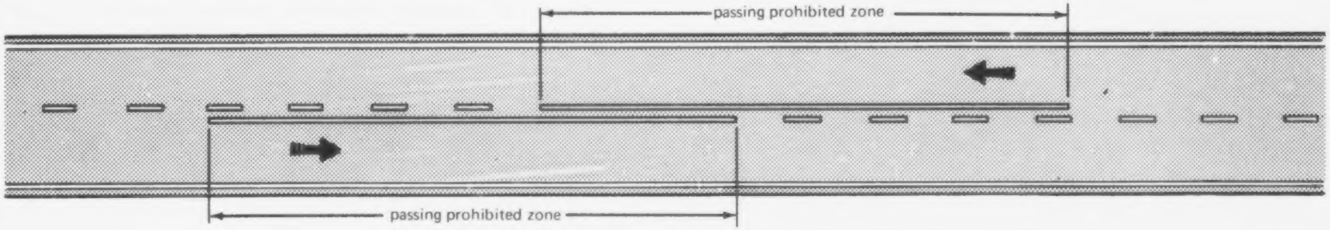
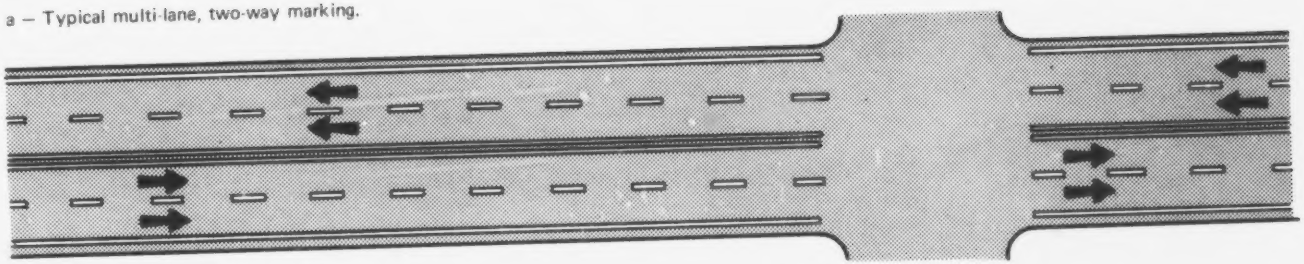

passing prohibited zone
passing prohibited zone

Figure 3-3. Typical 2-lane, two-way marking applications.

a – Typical multi-lane, two-way marking.



b – Typical multi-lane, two way marking with single lane left turn channelization.

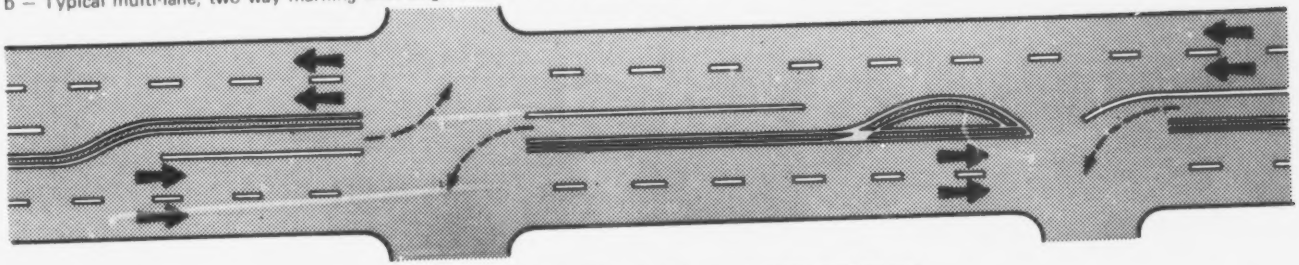
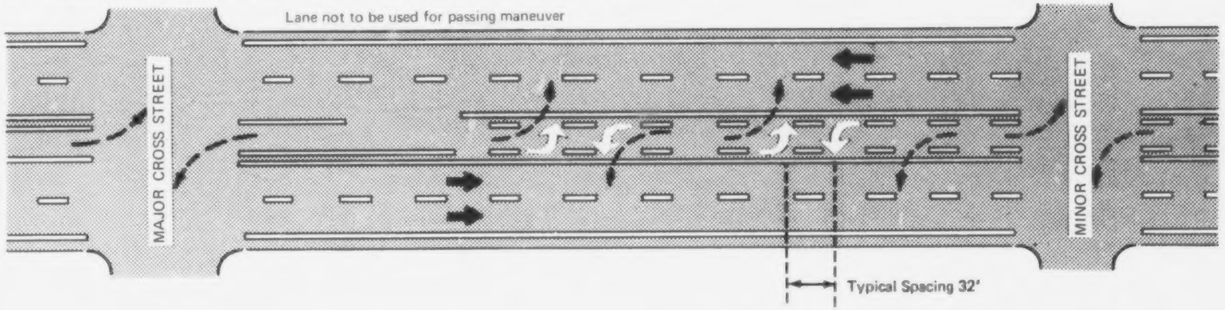


Figure 3-4. Typical multilane, two-way marking applications.

a – Typical multi-lane, two-way marking with single lane, two-way left turn channelization.


Lane not to be used for passing maneuver
MAJOR CROSS STREET
MINOR CROSS STREET
Typical Spacing 32'

b - Typical multi-lane, two-way marking with restricted lanes.

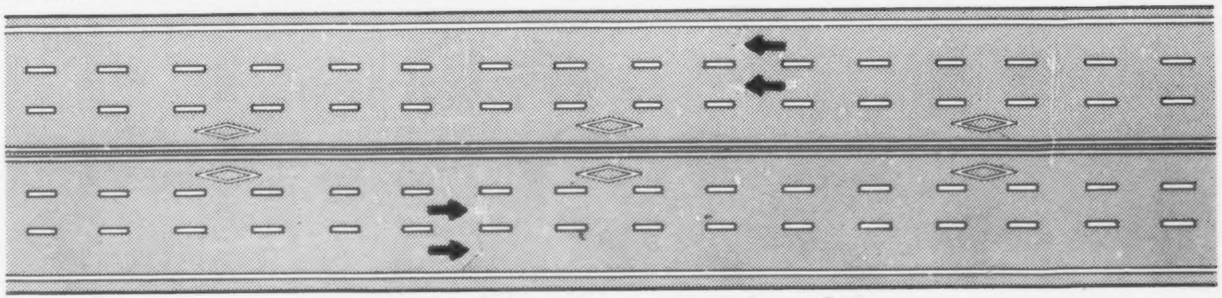
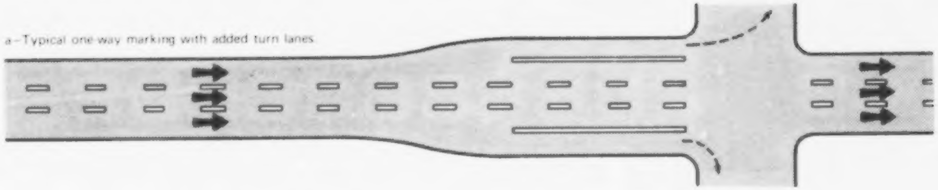
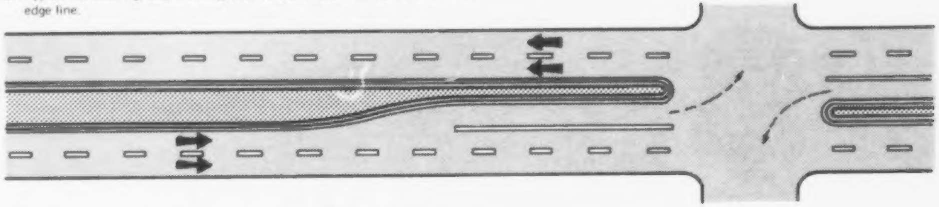


Figure 3-5. Typical multilane, two-way marking applications.

a–Typical one-way marking with added turn lanes



b–Typical divided highway marking with raised median and optional median edge line.



c–Typical divided highway marking with flush median and optional transverse shoulder marking.

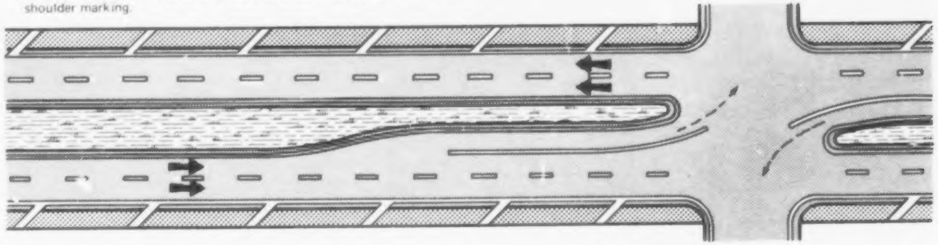


Figure 3-6. Typical one-way and divided highway marking applications.

In addition to the pavement markings here prescribed, no-passing zone signs (secs. 2B-21, 2B-22 and 2C-38) may be used to emphasize the existence and extent of a no-passing zone.

Where the distance between successive no-passing zones is less than 400 feet, the appropriate no-passing marking (one direction or two direction) should connect the zones.

The no-passing marking is also used on two-way roadways at pavement width transitions (sec. 3B-8) and on approaches to obstructions which must be passed on the right (sec. 3B-13). It may also be used on approaches to railroad grade crossings and other locations where passing should be prohibited.

3B-5 Warrants for No-Passing Zones at Curves

A no-passing zone at a horizontal or vertical curve is warranted where the sight distance, as defined below, is less than the minimum necessary for safe passing at the prevailing speed of traffic. Passing sight distance on a vertical curve is the distance at which an object 3.50 feet above the pavement surface can just be seen from a point 3.50 feet above the pavement (fig. 3-8a). Similarly, passing sight distance on a horizontal curve is the distance measured along the center line (or right hand lane line of a three-lane highway) between two points 3.50 feet above the pavement on a line tangent to the embankment or other obstruction that cuts off the view on the inside of the curve (fig. 3-8b). Where center lines are installed and a curve warrants a no-passing zone, it should be so marked where the sight distance is equal to or less than that listed below for the prevailing off-peak 85 percentile speed:

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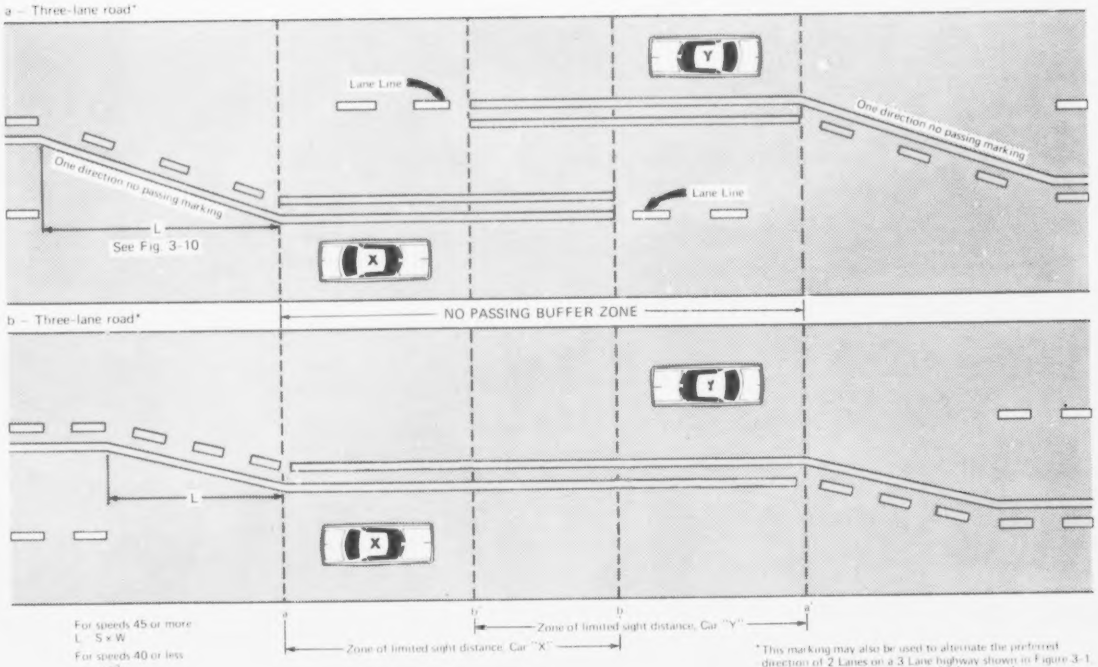
85 Percentile Speed (MPH)	Minimum Passing Sight Distance (Feet)
30	500
40	600
50	800
60	1000
70	1200

The beginning of a no-passing zone (point "a," fig. 3-8) is that point at which the sight distance first becomes less than that specified in the above table. The end of the zone (point "b") is that point at which the sight distance again becomes greater than the minimum specified.

3B-6 Pavement Edge Lines

Pavement edge line markings provide an edge of pavement guide for drivers. They have a unique value as a visual reference for the guidance of drivers during adverse weather and visibility conditions. They also may be used where edge delineation is desirable to reduce driving on paved

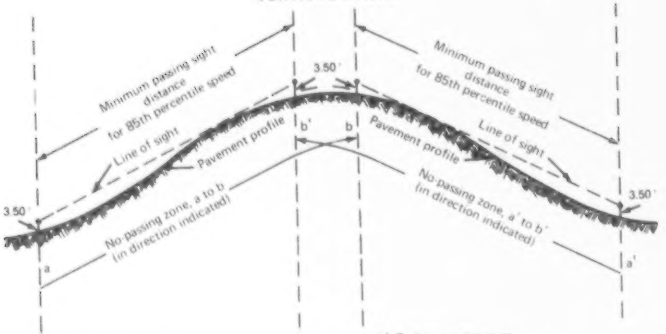

a – Three-lane road*
Lane Line
One direction no passing marking
One direction no passing marking
Lane Line
L
See Fig. 3-10
Y
X
NO PASSING BUFFER ZONE
b – Three-lane road*
Y
L
X
a
b'
b
a'
Zone of limited sight distance, Car "Y"
Zone of limited sight distance, Car "X"

For speeds 45 or more
$L = S \times W$
For speeds 40 or less
$L = \frac{WS^2}{60}$

*This marking may also be used to alternate the preferred direction of 2 Lanes on a 3 Lane highway shown in Figure 3-1 in this case b to a' & a to b' = 300' b' to b = 50'

Figure 3-7. Standard 3-lane, two-way pavement marking for alternating preferred direction of two lanes.

VERTICAL CURVE


Minimum passing sight distance for 85th percentile speed
Minimum passing sight distance for 85th percentile speed
3.50'
3.50'
3.50'
Line of sight
Line of sight
Pavement profile
Pavement profile
b'
b
No-passing zone, a to b (in direction indicated)
No-passing zone, a' to b' (in direction indicated)
a
a'

a, a' Begin no-passing zone

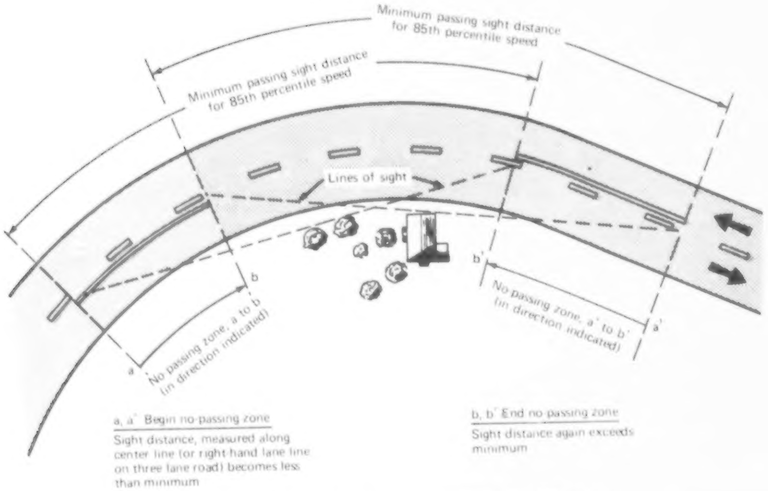
Sight distance becomes less than minimum measured between points 3.50 feet above pavement

b, b' End no-passing zone

Sight distance again exceeds minimum

Note: No-passing zones in opposite directions may or may not overlap, depending on alignment.

HORIZONTAL CURVE


Minimum passing sight distance for 85th percentile speed
Minimum passing sight distance for 85th percentile speed
Lines of sight
b
b'
a
a'
No-passing zone, a to b (in direction indicated)
No-passing zone, a' to b' (in direction indicated)

a, a' Begin no-passing zone

Sight distance, measured along center line (or right-hand lane line on three lane road) becomes less than minimum

b, b' End no-passing zone

Sight distance again exceeds minimum

Note: No-passing zones in opposite directions may or may not overlap, depending on alignment.

Figure 3-8. Method of locating and determining the limits of no-passing zones at vertical and horizontal curves.

shoulders or refuge areas of lesser structural strength than adjacent pavement. Edge lines shall not be continued through intersections and should not be broken for driveways.

Edge lines shall be provided on all Interstate highways, on rural multilane divided highways, and may be used on other classes of roads. The lines shall be white except that on the left edge of each roadway of divided streets and highways, and one-way roadways in the direction of travel, they shall be yellow.

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3B-7 Pavement Marking Extensions Through Intersections or Interchanges

Where road design or reduced visibility conditions make it desirable to provide control or to guide vehicles through an interchange or intersection, (such as at offset, skewed, complex multi-legged intersections or where multiple turn lanes are used) a dotted line may be used to extend markings as necessary through the interchange or intersection area (figs. 3-9a, 3-11). Where a greater degree of restriction is required, solid lane lines or channelizing lines may be continued through intersections. A frequent use for the channelizing line is to separate turning movements (figs. 3-9b, 3-9c).

3B-8 Lane Reduction Transitions

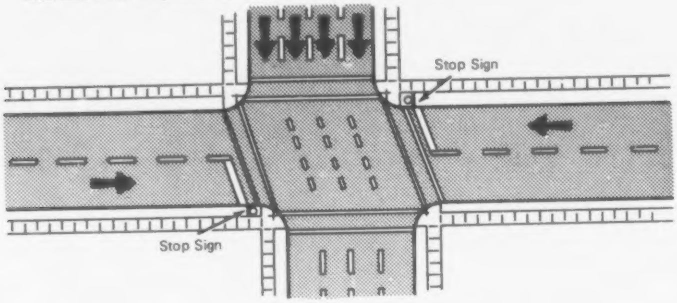
Where pavement markings are used, lane reduction markings shall be used to guide traffic at points where the pavement width changes to a lesser number of through lanes. No-passing markings shall be used to prohibit passing in the direction of the convergence, throughout the transition area. The length of transition (taper length) for a lane reduction should be computed by the formula $L = WS$ for freeways, expressways, and all other roadways having a posted speed of 45 m.p.h. or greater. Formula $L = WS^2/60$ should be used to compute taper length on urban, residential, and other streets where the posted speeds are 40 m.p.h. or less. Under both formulas, L equals the taper length in feet, W the offset distance in feet, and S the off-peak 85 percentile speed in miles per hour. On new construction, where no 85 percentile speed is established, the design speed may be used.

A number of situations are possible, as illustrated in figure 3-10, depending on which lanes must be offset or terminated and the amount of offset. One or more lane lines must be connected in such a way as to merge traffic into the reduced number of lanes.

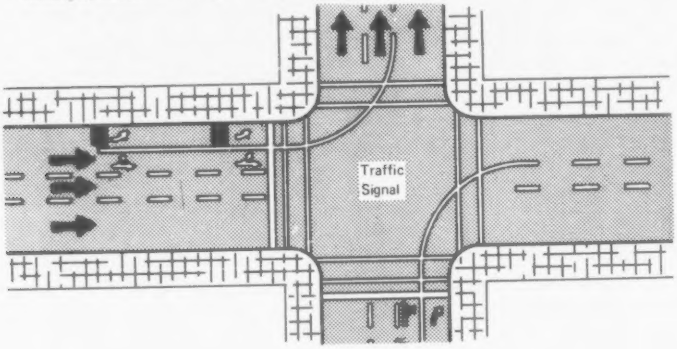
Lane lines should be discontinued one-quarter of the distance between the Pavement Width Transition sign (sec. 2C-19) and the point of convergence. Edge lines should be installed from the location of the warning sign, past the beginning of the narrower roadway (fig. 3-10).

Pavement markings at pavement-width transitions supplement the standard signs.

a–Typical pavement marking with offset lane lines continued through the intersection and optional crosswalk lines and stop limit lines.


Stop Sign
Stop Sign

b–Typical pavement marking with optional double turn lane lines, pavement messages, crosswalk lines, and stop limit lines.


Traffic Signal

c–Typical pavement marking with optional turn lane lines, crosswalk lines, and stop limit lines.

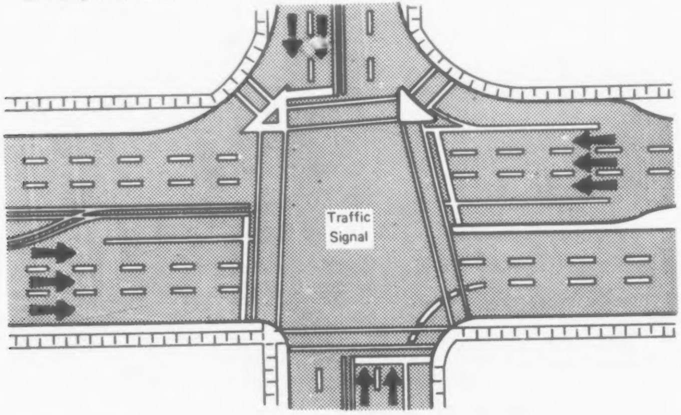
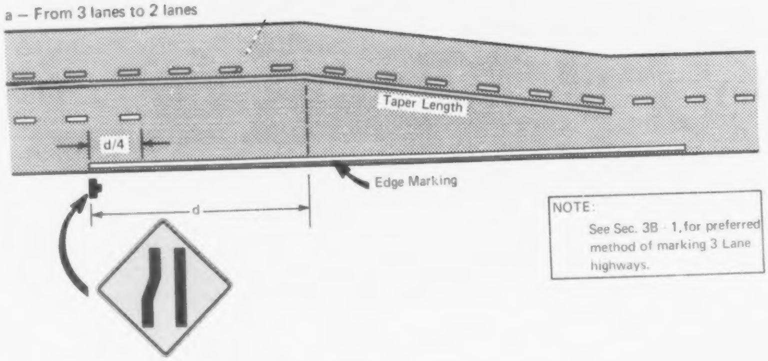

Traffic Signal

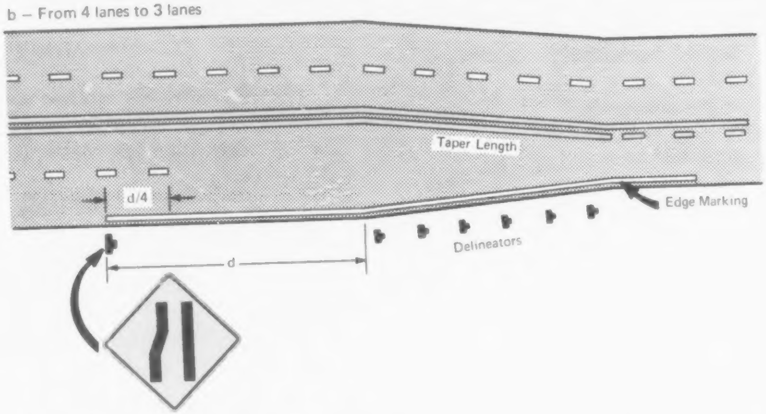
Figure 3-9. Typical pavement marking applications.

a – From 3 lanes to 2 lanes

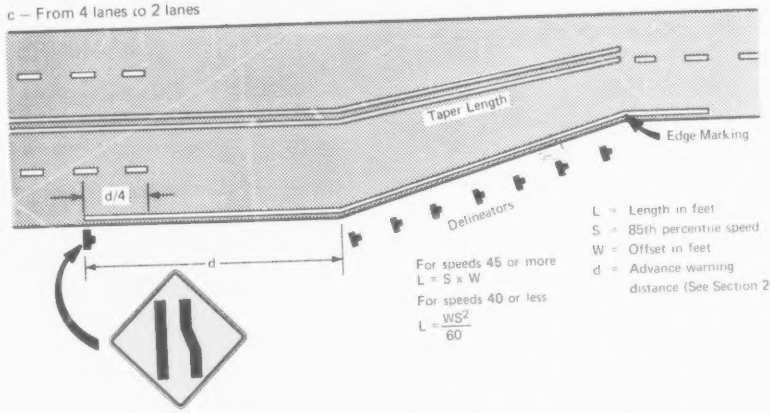

Taper Length
d/4
Edge Marking
d

NOTE:
See Sec. 3B - 1, for preferred method of marking 3 Lane highways.

b – From 4 lanes to 3 lanes


Taper Length
d/4
Edge Marking
Delineators
d

c – From 4 lanes to 2 lanes


Taper Length
Edge Marking
d/4
Delineators
d

For speeds 45 or more
$L = S \times W$

For speeds 40 or less
$L = \frac{WS^2}{60}$

L = Length in feet
S = 85th percentile speed
W = Offset in feet
d = Advance warning distance (See Section 2C-3)

Figure 3-10. Typical lane reduction transition markings and signs.

3B-9 Channelizing Line

The channelizing line shall be a wide or double solid white line.

The channelizing line may be used to form traffic islands where travel in the same direction is permitted on both sides. Other markings in the island area such as crosshatching shall be white.

Typical examples of channelizing line applications are shown in figures 3-9, 3-11, 3-12 and 3-13.

3B-10 Median Islands Formed by Pavement Markings

Two double solid yellow lines shall be used to form continuous median islands where these islands separate travel in opposite directions. Other markings in the median island area such as crosshatching shall be yellow (sec. 3A-8).

3B-11 Marking of Interchange Ramps

Channelizing lines at exit ramps provide a neutral area which reduces the probability of collision with the curb nose and also directs exiting traffic at the proper angle for smooth divergence into the ramp (fig. 3-11). The channelizing line promotes safe and efficient merging with the through traffic at entrance ramps (fig. 3-12).

For exit ramps, channelizing lines shall be placed along both sides of the neutral area between the main roadway and the exit ramp lane. With a parallel deceleration lane, a lane line shall be extended from the beginning of the channelizing line upstream for a distance of approximately one-half the length of the full width deceleration lane. White transverse markings may be placed in the neutral area for special emphasis.

III-18 (c)
Rev. 2

For entrance ramps, a channelizing line should be placed along the side of the neutral area adjacent to the ramp lane. With a parallel acceleration lane, a lane line should be extended from the end of the channelizing line for a distance approximately one-half the length of the full width acceleration lane. With a tapered acceleration lane, a lane line may be placed to extend the channelizing line, but not beyond a point where the tapered lane meets the near side of the through traffic lane. Pavement marking arrow usage for Wrong-Way traffic is included in Section 2E-41.

III-16 (c)
Rev. 2

In advance of lane drops at off ramps a special marking pattern may be used to distinguish the lane drop situation from a normal exiting ramp or an auxiliary lane. A typical special marking for lane drops consists of 8-inch wide by 3-foot long white stripes separated by 12-foot gaps. If used, this special marking should begin ½ mile in advance of the theoretical gore point. Where last minute lane changes may cause conflicts, an 8-inch wide solid white channelizing line may extend approximately 300 feet upstream from the theoretical gore point.

III-10 (c)
Rev. 3

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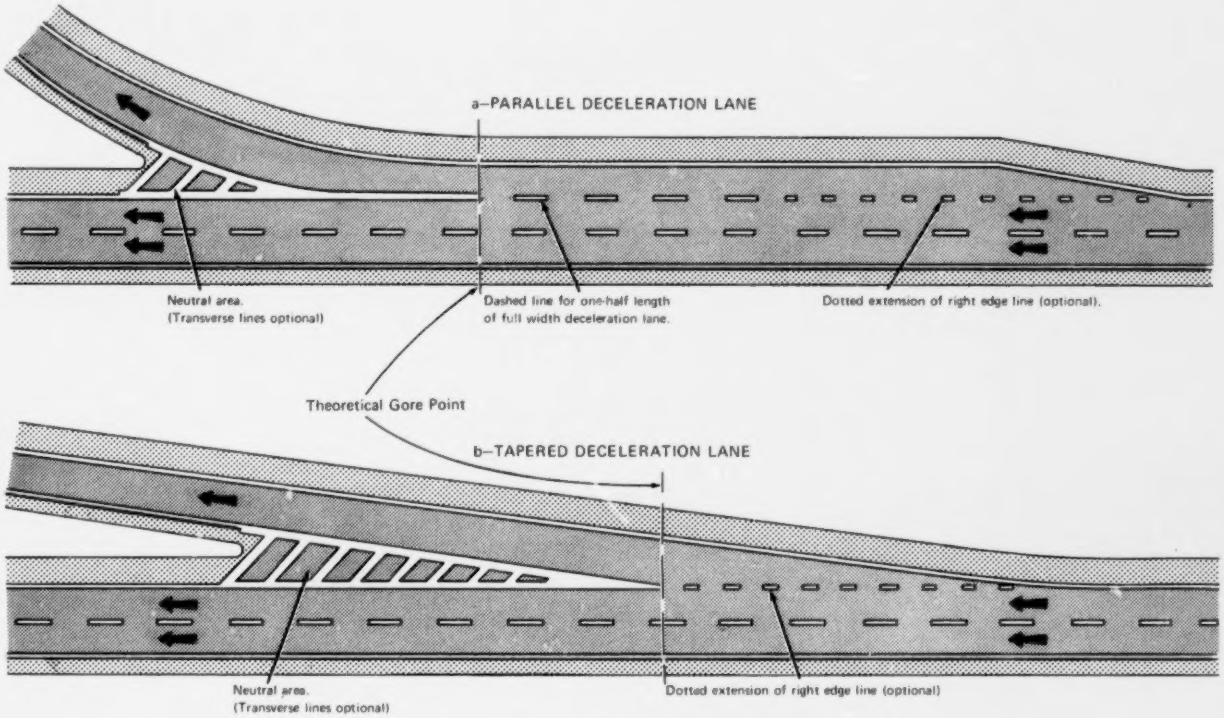

a–PARALLEL DECELERATION LANE
Neutral area.
(Transverse lines optional)
Dashed line for one-half length of full width deceleration lane.
Dotted extension of right edge line (optional).
Theoretical Gore Point
b–TAPERED DECELERATION LANE
Neutral area.
(Transverse lines optional)
Dotted extension of right edge line (optional)

Figure 3-11. Typical exit ramp markings.

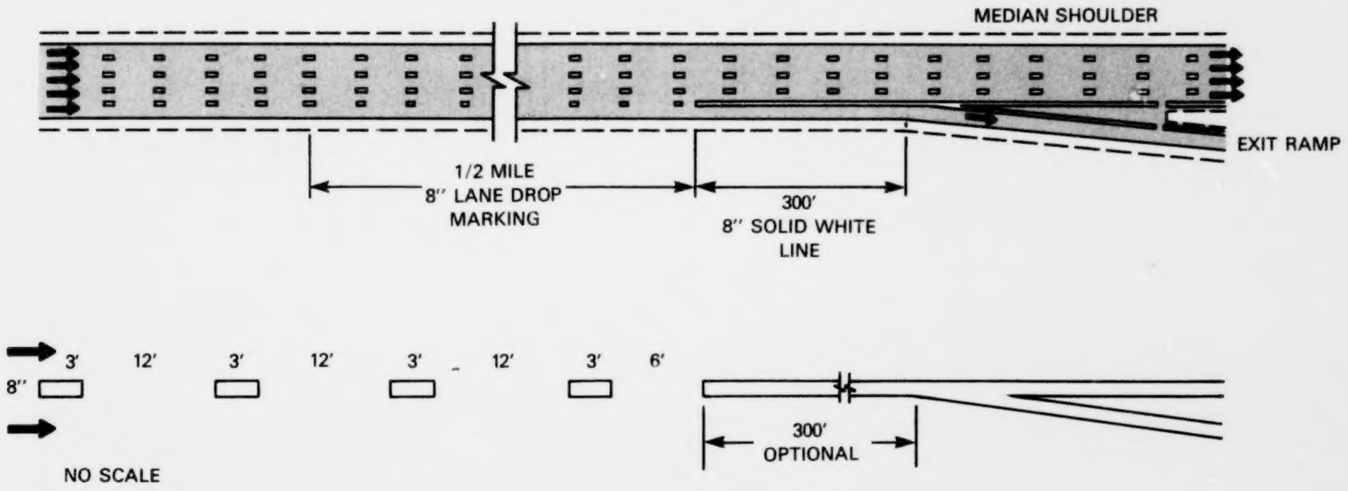
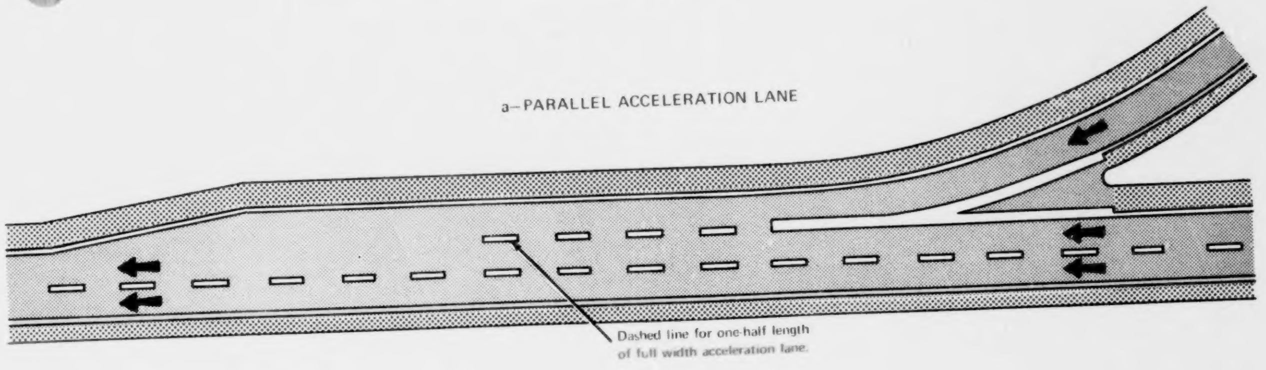

MEDIAN SHOULDER
EXIT RAMP
1/2 MILE
8'' LANE DROP
MARKING
300'
8'' SOLID WHITE
LINE
3'
12'
3'
12'
3'
12'
3'
6'
8''
300'
OPTIONAL
NO SCALE

Figure 3-11a. Lane drop markings at exit ramps

a–PARALLEL ACCELERATION LANE


Dashed line for one-half length of full width acceleration lane.

b–TAPERED ACCELERATION LANE

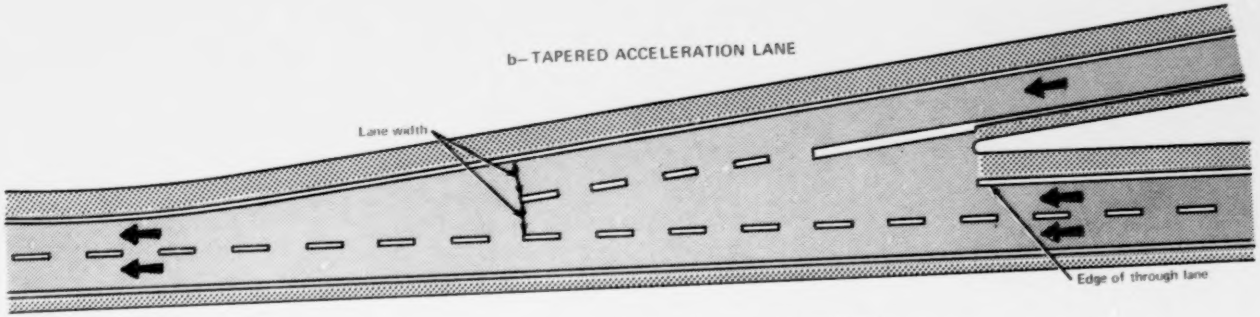

Lane width
Edge of through lane

Figure 3-12. Typical entrance ramp markings.

3B-12 Combination Lane and Center Line Markings for Unique Applications

It is sometimes necessary to use markings in certain combinations not previously described for special applications intended to improve traffic operations.

For reversible lane markings, each edge of the lane shall be marked by the use of a double, normal, broken yellow line with the gaps and segments adjacent to one another. Signs and/or signals shall be used to supplement the pavement markings (fig. 3-1, page 3B-3).

A two-way left turn lane is a lane reserved in the center of a highway for exclusive use of left turn vehicles and shall not be used for passing and overtaking or travel by a driver except to make a left turn. The lane may be used by drivers making the left turn in either direction. A two-way left turn lane shall be marked by a single direction, no-passing marking on each edge of the lane and pavement marking arrows as shown in figure 3-5a. This is generally used on a five lane highway where there are two lanes of through traffic in each direction. Signs should be used with the pavement markings (sec. 2B-19).

II-75(c)
Rev. 4

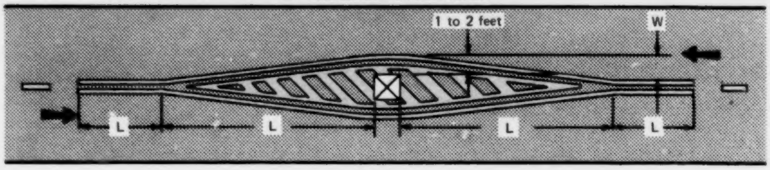
3B-13 Approach to an Obstruction

Pavement markings shall be used to guide traffic on the approach to fixed obstructions within a paved roadway. An obstruction may be so located that all traffic must keep to the right of it, or it may be between two lanes of traffic moving in the same direction. The markings in either case must be designed to guide traffic away from the obstruction. The use of channelizing lines or no-passing markings are generally effective. Obstruction approach markings for bridge supports, refuge islands, median islands, and channelization islands shall consist of a diagonal line, or lines, extending from the center line or the lane line to a point 1 or 2 feet to the right side, or to both sides, of the approach end of the obstruction (fig. 3-13).

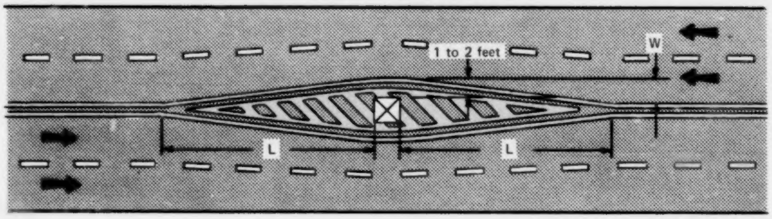
The length of the diagonal markings (taper length) should be computed by the formula $L = WS$ for freeways, expressways and all other roadways having a posted speed of 45 m.p.h. or greater. The formula $L = WS^2/60$ should be used to compute taper length on urban, residential, and other streets where the posted speeds are 40 m.p.h. or less. Under both formulas, L equals the taper length in feet, W the width of the offset in feet, and S the off-peak 85 percentile speed in miles per hour. The minimum taper length shall be 100 feet in urban areas and 200 feet in rural areas.

If traffic is required to pass only to the right of the obstruction, the marking shall consist of a no-passing marking at least twice the length of the diagonal portion determined by the applicable taper formula (above). Yellow markings may be placed in the triangular area so formed.

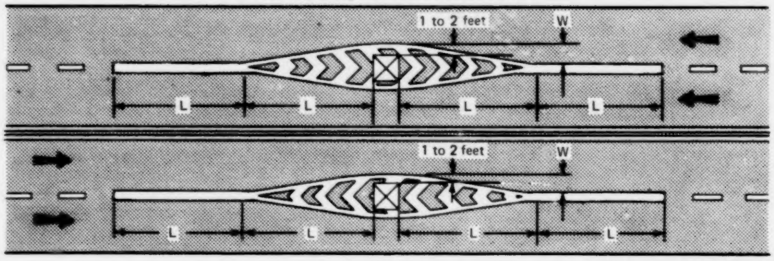
a – Center of two-lane road.


1 to 2 feet
W
L
L
L
L

b – Center of four-lane road.


1 to 2 feet
W
L
L

c – Traffic passing both sides of obstruction


1 to 2 feet
W
L
L
L
L
1 to 2 feet
W
L
L
L
L

For speeds 45 or more $L = S \times W$ For speeds 40 or less $L = \frac{WS^2}{60}$

S = 85th percentile speed in miles per hour
W = Offset distance in feet

Minimum length of: L = 100 feet in urban areas
L = 200 feet in rural areas

Length "L" should be extended as required by sight distance conditions.

Figure 3-13. Typical approach markings for obstructions in the roadway.

If traffic may pass either to right or left of the obstruction, the markings shall consist of two channelizing lines diverging from the lane line, one to either side of the obstruction for a length determined by the applicable taper formula. In advance of the point of divergence, a wide solid white line or double white line shall be extended in place of the broken lane line for a distance equal to the length of the diverging lines. Additional white markings may be placed in the triangular area between the channelizing lines.

3B-14 Pavement Markers as Vehicle Positioning Guides with Other Longitudinal Markings

Raised pavement markers may be used as positioning guides with other longitudinal markings, without necessarily conveying information to the motorist as to passing or lane use restrictions. In such applications, markers may be used, positioned between the two lines of a one-way or two-way no passing zone, or in line with or immediately adjacent to a single solid or broken center line or lane lines. On concrete pavements, the raised markers should be placed to one side of longitudinal joints. A typical spacing for such applications is 2N. (See Section 3A-10 for definition of N.) Where the driver's attention should be drawn to changes in travel path, such as sharp curves or transitions to reduce the number of lanes or shift traffic laterally, the spacing may be reduced to N, or less.

III-9(c)
Rev. 4

3B-15 Raised Pavement Markers Supplementing Other Markings

Raised pavement markers may be used to supplement other longitudnal markings. Where double lines are to be supplemented, pairs of markers placed laterally in line with, or immediately outside of the two lines, should normally be used. When supplementing wide lines, raised pavement markers may be placed laterally adjacent to each other to simulate the width of the line.

1. Solid lines should be supplemented at a spacing no greater than "N", except left edge lines, which should be supplemented at a spacing no greater than N/2. Raised markers generally should not supplement right edge lines.

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Rev. 4

2. Broken lines should be supplemented at a spacing no greater than 2N, except those identifying reversible lanes, which should be supplemented at a spacing no greater than "N".

3. Dotted lines should be supplemented with spacing appropriate for the application. Typical spacing for pavement markings through at-grade intersections is one raised marker for each short line segment or "dot". For edge line extensions through freeway interchanges, the typical edge line spacing of N/2, may be used.

Raised pavement markers may also be used to supplement other markings for channelizing islands or approaches to obstructions. Positioning and spacing of the markers in such cases must be determined by engineering judgment. III-9(c) Rev. 4

3B-16 Substituting for Pavement Markings

Retroflective raised pavement markers, or non-retroflective raised pavement markers supplemented by retroflective markers, may be substituted for markings of other types.

The pattern of the raised markers should simulate the pattern of the markings for which they are substituted.

The normal spacing of raised pavement markers, when substituting for painted markers, should be chosen in relationship to the standard length of the broken line segment.

Broken line segments may be substituted by a group of four or five markers equally spaced at approximately N/12 feet, or at approximately the third point of the line sigment if N is other than 40 feet, with at least one of every group of markers retroreflective. III-9(c) Rev. 4

Solid lines may be substituted for at a spacing of approxiamtely N/8 feet, with retroreflective units at a spacing no greater than N/2.

Dotted lines shall be substituted for at a spacing of approximately N/8 feet, but with not less than one raised pavement marker per dotted line. At least one raised marker every N feet shall be retroreflective.

When substituting for wide lines, raised pavement markers may be placed laterally adjacent to simulate the width of the line.

3B-17 Stop Lines

III-9(c) Rev. 4

Stop lines are solid white lines, normally 12 to 24 inches wide, extending across all approach lanes.

Stop lines should be used in both rural and urban areas where it is important to indicate the point, behind which vehicles are required to stop, in compliance with a STOP sign, traffic signal, officers' direction, or other legal requirement.

Stop lines, where used, should ordinarily be placed 4 feet in advance of and parallel to the nearest crosswalk line. In the absence of a marked crosswalk, the Stop line should be placed at the desired stopping point, in no case more than 30 feet or less than 4 feet from the nearest edge of the intersecting roadway.

If a stop line is used in conjunction with a STOP sign, it should ordinarily be placed in line with the STOP sign. However, if the sign cannot be located exactly where vehicles are expected to stop, the Stop line should be placed at the stopping point.

3B-18 Crosswalks and Crosswalk Lines

III-9(c) Rev. 4

Crosswalk markings at signalized intersections and across intersectional approaches on which traffic stops, serve primarily to guide pedestrians in the proper paths. Crosswalk markings across roadways on which traffic is not controlled by traffic signals or STOP signs, must also serve to warn the motorist of a pedestrian crossing point. At non-intersectional locations, these markings legally establish the crosswalk.

Crosswalk lines shall be solid white lines, marking both edges of the crosswalk. They shall be not less than 6 inches in width and should not be spaced less than 6 feet apart. Under special circumstances where a stop line is not provided or where vehicular speeds exceed 35 MPH or where crosswalks are unexpected, it may be desirable to increase the width of the crosswalk line up to 24" in width. Crosswalk lines on both sides of the crosswalk should extend across the full width of pavement to discourage diagonal walking between crosswalks (fig. 3–14a).

Crosswalks should be marked at all intersections where there is substantial conflict between vehicle and pedestrian movements. Marked crosswalks should also be provided at other appropriate points of pedestrian concentration, such as at loading islands, midblock pedestrian crossing, or where pedestrians could not otherwise recognize the proper place to cross.

Crosswalk markings should not be used indiscriminately. An engineering study should be required before they are installed at locations away from traffic signals or STOP signs.

Since non-intersectional pedestrian crossings are generally unexpected by the motorist, warning signs (sec. 2C–31) should be installed and adequate visibility provided by parking prohibitions.

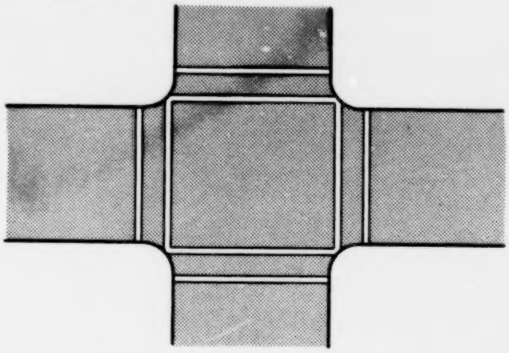
For added visibility, the area of the crosswalk may be marked with white diagonal lines at a 45° angle or with white longitudinal lines at a 90° angle to the line of the crosswalk (figs. 3–14b, 14c). These lines should be approximately 12" to 24" wide and spaced 12" to 24" apart. When diagonal or longitudinal lines are used to mark a crosswalk, the transverse crosswalk lines may be omitted. This type of marking is intended for use at locations where substantial numbers of pedestrians cross without any other traffic control device, at locations where physical conditions are such that added visibility of the crosswalk is desired or at places where a pedestrian crosswalk might not be expected. Care should be taken to insure that crosswalks with diagonal or longitudinal lines used at some locations do not weaken or detract from other crosswalks (where special emphasis markings are not used) (fig. 3–14a). When an exclusive pedestrian phase signal, which permits diagonal crossing, is installed at an intersection, a unique marking may be used for the crosswalk (fig. 3–15).

3B–19 Parking Space Markings

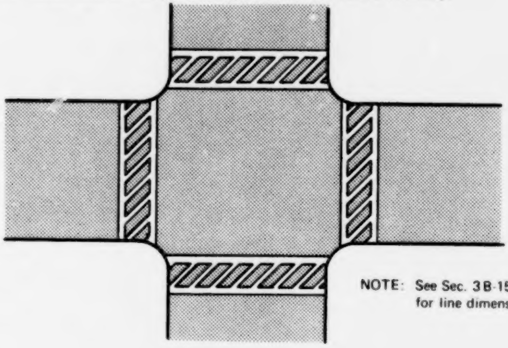
III-9(c)
Rev. 4

Parking space markings shall be white.

The marking of parking space limits on urban streets encourages more orderly and efficient use of parking spaces where parking turnover is a – Standard crosswalk marking.



b – Crosswalk marking with diagonal lines for added visibility.



NOTE: See Sec. 3B-15
for line dimensions

c – Crosswalk marking with longitudinal lines for added visibility.

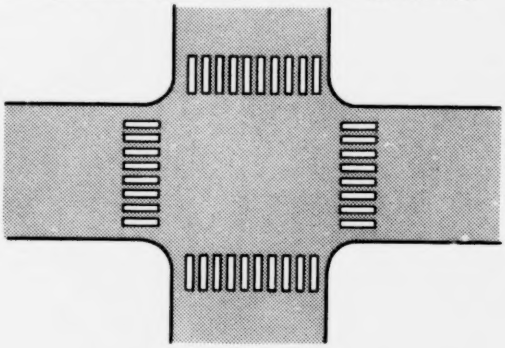
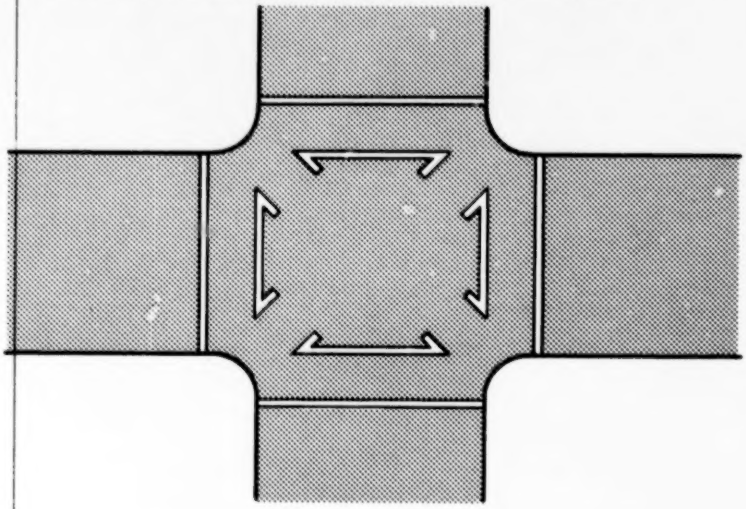


Figure 3-14. Typical crosswalk markings.

a – Crosswalk marking that outlines pedestrian travel paths.



b – Crosswalk marking that outlines the edge of pedestrian travel area.

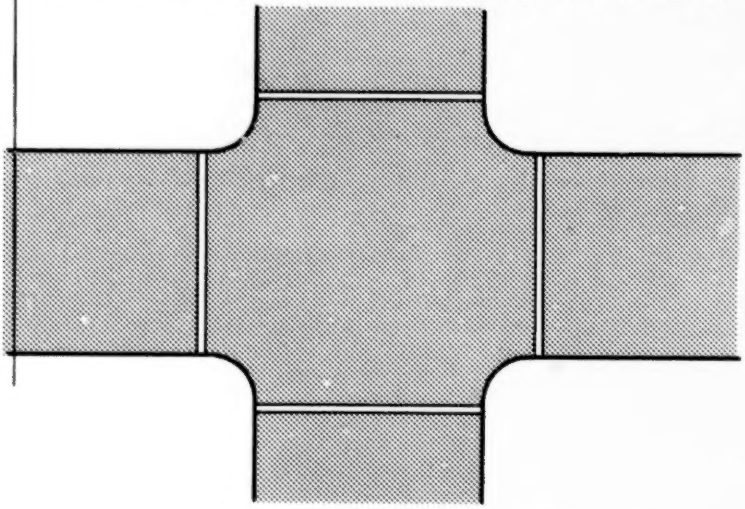


Figure 3-15. Typical crosswalk marking for exclusive pedestrian phase.

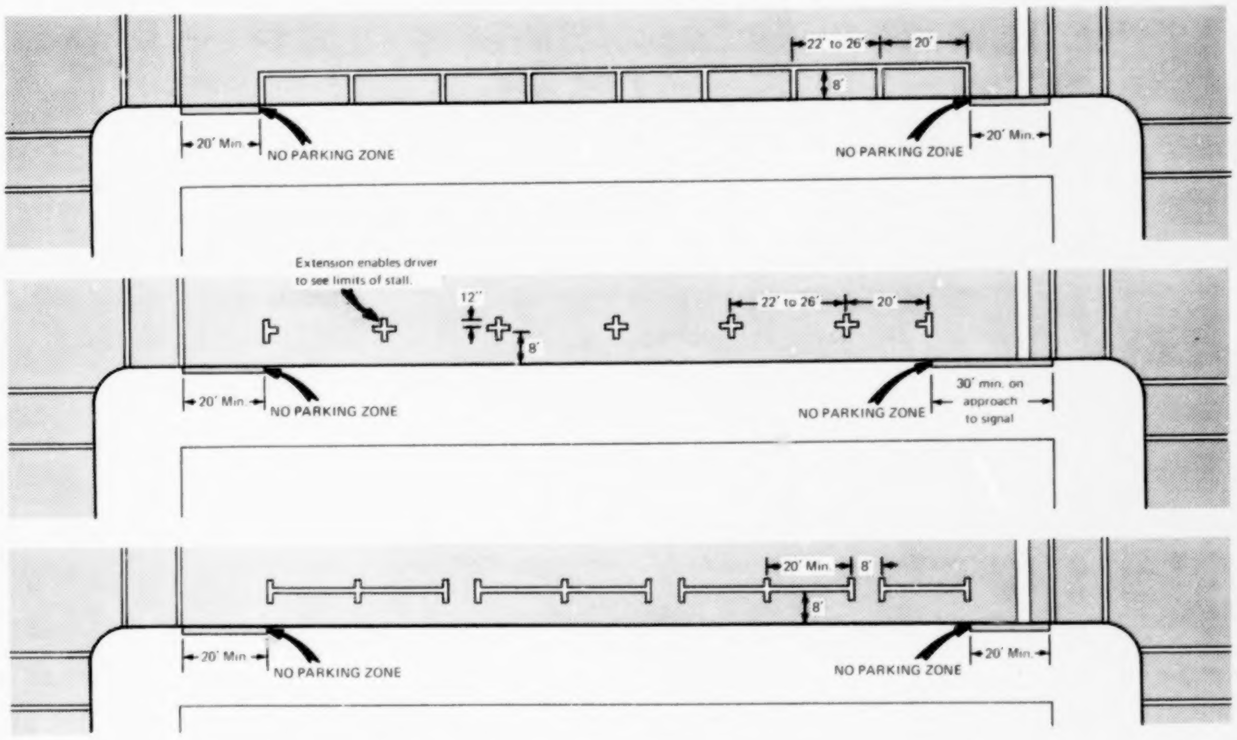

22' to 26'
20'
8'
20' Min.
NO PARKING ZONE
NO PARKING ZONE
20' Min.
Extension enables driver to see limits of stall.
12"
8'
22' to 26'
20'
20' Min.
NO PARKING ZONE
NO PARKING ZONE
30' min. on approach to signal
20' Min.
8'
8'
20' Min.
NO PARKING ZONE
NO PARKING ZONE
20' Min.

Figure 3-16. Typical parking-space limit markings.

substantial and tends to prevent encroachment on fire hydrant zones, bus stops, loading zones, approaches to corners, clearance spaces for islands and other zones where parking is prohibited. Typical parking space markings are shown in figure 3-16.

3B-20 Pavement Word and Symbol Markings

III-9(c)
Rev. 4

Word and symbol markings on the pavement may be used for the purpose of guiding, warning, or regulating traffic. They should be limited to not more than a total of three lines of information. They shall be white in color.

Symbol arrows may be used to convey either guidance or mandatory messages; however, where a movement that would otherwise be legal is to be prohibited, the arrow marking must be accompanied by standard signs and the word marking "ONLY." Signs or markings should be repeated in advance of mandatory turn lanes when necessary to prevent entrapment and to help motorists select the appropriate lane before reaching the end of the line of waiting vehicles.

All letters, numerals and symbols should be in conformance with the Standard Alphabets for Highway Signs and Pavement Markings.* Large letters and numerals should be used, 8 feet or more in height; and, if the message consists of more than one word, it should read "up," i.e., the first word should be nearest to the driver. Symbol messages are generally preferable to word messages.

Where speeds are low, somewhat smaller characters may be used. The space between lines should be at least four times the height of the characters for low speed roads but not more than ten times the height of the characters, under any conditions. Examples are shown in figures 3-17 and 3-18.

Word and symbol markings considered appropriate for use when warranted include the following:

1. Regulatory:
    - "STOP"
    - "RIGHT (LEFT) TURN ONLY"
    - "25 MPH"
    - "SYMBOL ARROWS" (Note: Symbol arrows shall be supplemented by word "ONLY," if mandatory.)
2. Warning:
    - "STOP AHEAD"
    - "SIGNAL AHEAD"
    - "SCHOOL"
    - "SCHOOL X-ING"
    - "PED X-ING"
    - "R X R" (Railroad Crossing) (secs. 8B-2, 8B-3)

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* Available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590.

3. Guide:
"US 40"
"ROUTE 40"
"STATE 135" (Other words or symbols may be necessary under certain conditions.)

Since an uncontrolled use of pavement markings can result in driver confusion the number of different word and symbol markings should be minimized.

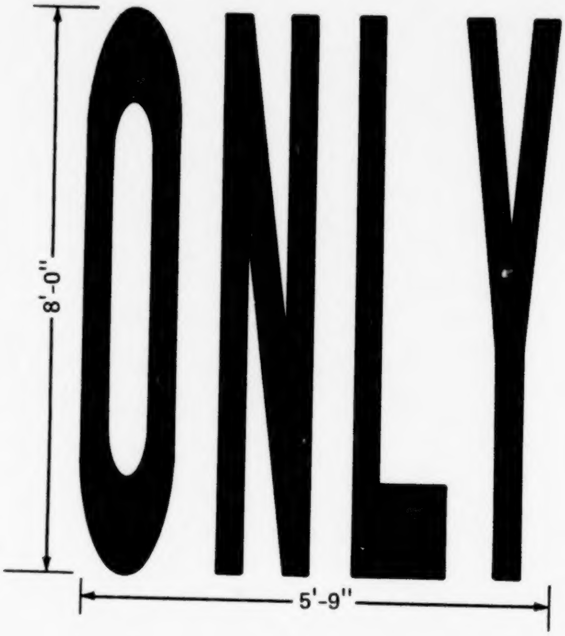


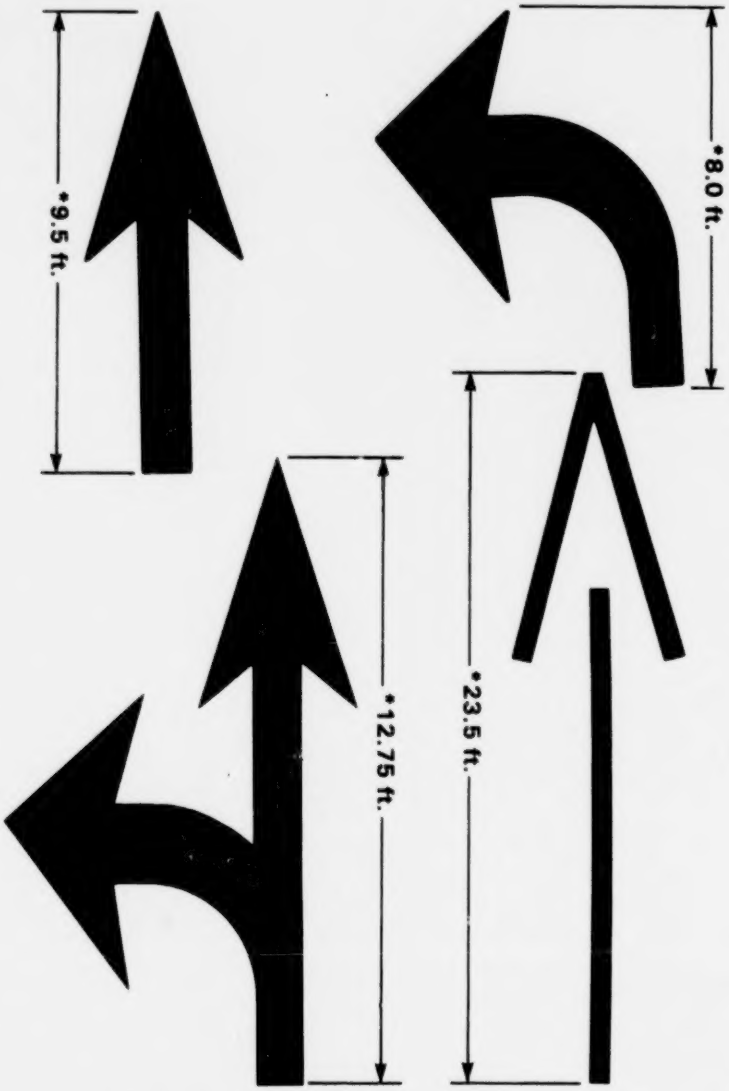
Figure 3-17. Elongated letters for pavement marking.

The word "STOP" shall not be used on the pavement unless accompanied by a stop line (sec. 3B-14) and STOP sign (sec. 2B-4).

The word STOP shall not be placed on the pavement in advance of a stop line, unless every vehicle is required to stop at all times.

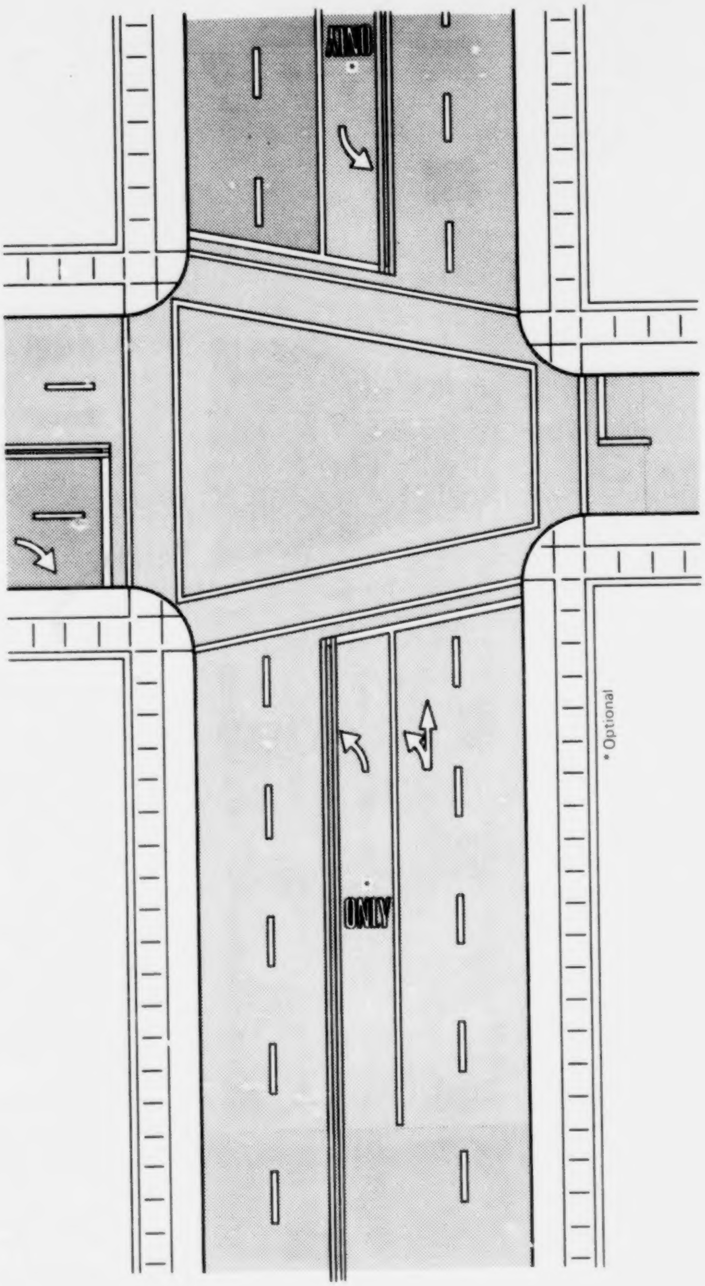
Pavement messages should generally be no more than one lane in width except the "SCHOOL" messages (sec. 7C-6).

Figure 3-19 shows the use of word and symbol markings on the pavement.



• Minimum sizes for normal installation; larger sizes may be needed for freeways, above average speeds, and other critical conditions. For proper proportion, see Standard Alphabets for Highway Signs and Pavement Markings (available from FHWA, HTO-20, Washington, D.C. 20590).

Figure 3-18. Elongated arrows for pavement markings.



* Optional

Figure 3-19. Typical lane-use-control word and symbol markings.

3B-21 Curb Markings for Parking Restrictions

III-9(c) Rev

Since curb markings of yellow and white are used for delineation and visibility, it is usually advisable to establish parking regulations through the installation of standard signs (secs. 2B-31 to 33). However, when local authorities prescribe special colors for curb markings as supplemental to standard signs, they may be used.

When signs are not used, intended meaning should be stenciled on the curb.

Signs shall always be used with curb markings in those areas where curb markings are frequently obliterated by accumulations of snow and ice.

3B-22 Preferential Lane Markings

III-9(c) Rev. 4

When a lane is assigned full or part time to a particular class or classes of vehicles, the preferential lane markings shall be used.

The marking is intended to convey that a restriction on the class or classes of vehicles permitted to use the lane exists, and it is supplemental to signs or signals conveying the specific restrictions. Signs or signals shall be used with the preferential lane markings.

The preferential lane marking shall be the elongated diamond detailed in the Standard Alphabets for Highway Signs and Pavement Markings.* The diamond shall be formed by white lines at least 6 inches in width, shall be at least 2 ½ feet in width and 12 feet long and shall be placed coincident with the longitudinal center of each restricted lane.

The frequency with which the marking is placed is a matter for engineering judgment based on prevailing speed, block lengths, distance from intersections, and other considerations necessary to adequately communicate with the driver. Spacing as close as 80 feet may be appropriate for a city street, while a spacing of 1000 feet may be appropriate for a freeway.

Word markings may be used to supplement but not substitute for the preferential lane markings.

3B-23 Speed Measurement Markings

III-9(c) Rev. 4

A speed measurement marking is a transverse marking placed on the roadway for the purpose of assisting in the enforcement of speed regulations. Speed measurement markings, if used, shall be white, and shall be not greater than 24 inches wide. They may extend approximately 2 feet on either side of the centerline or edgeline of the paved surface at ¼ mile intervals over a 1-mile length of roadway. Advisory signs may be used in conjunction with these markings.

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* Available from FHWA (HTO-20), Washington, D.C. 20590.

C. OBJECT MARKINGS

3C-1 Object Marker Design

Object markers are used to mark obstructions within or adjacent to the roadway. When used, these markers shall consist of an arrangement of one or more of the following designs:

Type 1—Either a marker consisting of nine yellow reflectors, each with a minimum dimension of approximately 3″, mounted symmetrically on an 18″ yellow or black diamond panel; or an all yellow reflective diamond panel of the same size. Type 1 markers may be larger if conditions warrant.

Type 2—Either a marker consisting of three yellow reflectors, each with a minimum dimension of approximately 3″, arranged either horizontally or vertically; or an all yellow reflective panel, 6″ × 12″. Type 2 markers may be larger if conditions warrant.

Type 3—Striped marker consisting of a vertical rectangle approximately 1 foot by 3 feet in size with alternating black and reflectorized yellow stripes sloping downward at an angle of 45° toward the side of the obstruction on which traffic is to pass. The minimum width of the yellow stripe shall be 3 inches. A better appearance can be achieved if the black stripes are wider than the yellow stripes. III-7 (c) Rev. 2

Type 3 object markers with stripes which begin at the upper right side and slope downward to the lower left side are to be designated as "right" object markers (OM-3R). Object markers with stripes which begin at the upper left side and slope downward to the lower right side are to be designated as "left" object markers (OM-3L).

3C-1.1 Mounting Height

When used for marking objects in the roadway or 8 feet or less from the shoulder or curb, the mounting height to the bottom of the object marker should normally be 4 feet above the surface of the nearest traffic lane. When used to mark objects more than 8 feet from the shoulder or curb, the mounting height to the bottom of the object marker may be 4 feet above the ground. III-23 (c) Rev. 3

When object markers or markings are applied to a hazardous object which by its nature requires a lower or higher mounting, the vertical mounting height may vary according to need.

3C-2 Objects in the Roadway

Obstructions within the roadway, shall be marked with a Type 1 or Type 3 object marker.

For additional emphasis, a large surface such as a bridge pier may be painted with diagonal stripes, 12 inches or greater in width, similar in design to the Type 3 object marker. The alternating black and reflectorized yellow stripes shall be sloped down at an angle of 45 ° toward the side of the obstruction which traffic is to pass. III-7 (c) Rev. 2

Appropriate signs (secs. 2B-25 and 2C-33) directing traffic to one or both sides of the obstruction may be used in lieu of the object marker. In addition to markings on the face of an obstruction in the roadway, warning of approach to the obstruction shall be given by appropriate pavement markings (sec. 3B-13). III-23 (c) Rev. 3

Where the vertical clearance of an overhead structure exceeds the maximum legal height of vehicle by less than one foot, the clearance in feet and inches should be clearly marked on the structure (sec. 2C-34).

3C-3 Objects Adjacent to the Roadway

Objects not actually in the roadway may be so close to the edge of the road that they need a marker. These include underpass piers, bridge abutments, handrails and culvert headwalls. In some cases there may not be a physical object involved, but other roadside conditions such as narrow shoulder drop-offs, gores, small islands and abrupt changes in the roadway alignment may make it undesirable for a driver to leave the roadway. Type 2 or 3 object markers are intended for use at such locations. The inside edge of the marker shall be in line with the inner edge of the obstruction.

Standard warning signs (Part II-C) should also be used where applicable. Typical applications of markers for roadside obstructions are shown in figure 3-20.

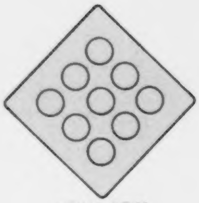
3C-4 End of Roadway

When it is determined that markers should be placed at the end of a roadway where there is no alternate vehicular path, either a marker consisting of nine red reflectors, each with a minimum dimension of approximately 3 ", mounted symmetrically on an 18-inch diamond, red or black panel; or an 18-inch diamond reflectorized red panel shall be used. More than one marker or a larger marker may be used at the end of the roadway where conditions warrant. The minimum mounting height of this marker shall be four feet. Appropriate advance warning signs should be used.

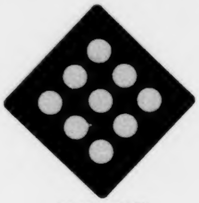
Editorial Change Rev. 2

Editorial Change Rev. 2

Typical Type 1 Object Markers



18"x18"



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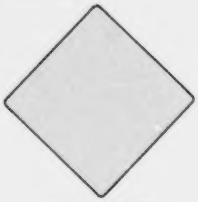
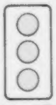


18"x18"

Typical Type 2 Object Markers



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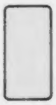

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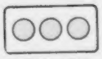

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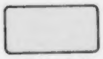
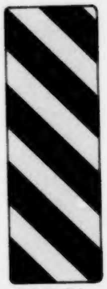
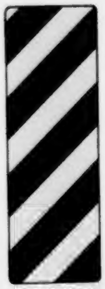


12"x6"

Typical Type 3 Object Markers

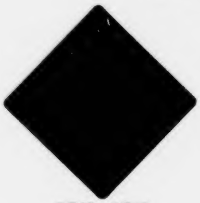


OM-3L
12"x36"



OM-3R
12"x36"

Typical End of Road Markers



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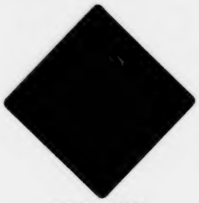

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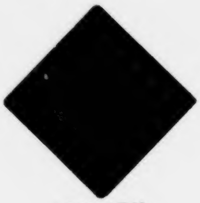
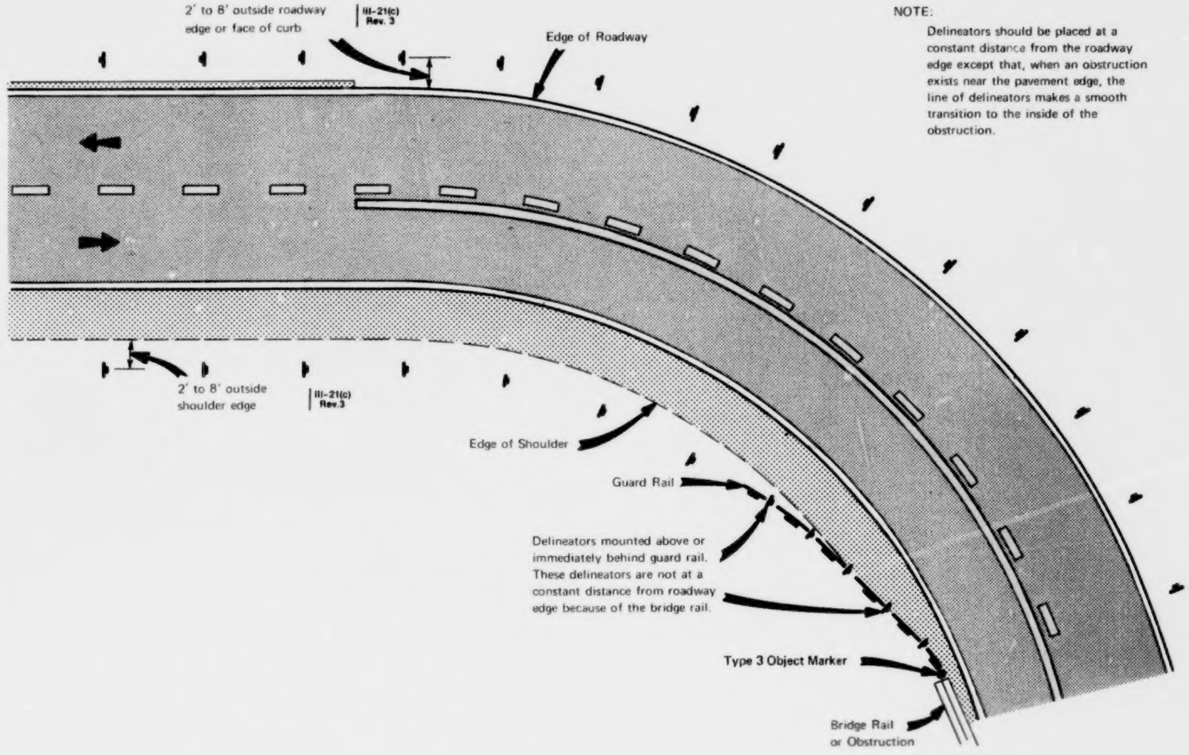


18"x18"


2' to 8' outside roadway edge or face of curb
III-21(c) Rev. 3
Edge of Roadway
2' to 8' outside shoulder edge
III-21(c) Rev.3
Edge of Shoulder
Guard Rail
Delineators mounted above or immediately behind guard rail. These delineators are not at a constant distance from roadway edge because of the bridge rail.
Type 3 Object Marker
Bridge Rail or Obstruction

NOTE:

Delineators should be placed at a constant distance from the roadway edge except that, when an obstruction exists near the pavement edge, the line of delineators makes a smooth transition to the inside of the obstruction.

Figure 3-20. Typical delineator installation.

D. DELINEATION

3D-1 Delineators

Road delineators are light-retroreflecting devices mounted at the side of the roadway, in series, to indicate the roadway alignment. Delineators are effective aids for night driving and are to be considered as guidance devices rather than warning devices. Delineators may be used on long continuous sections of highway or through short stretches where there are changes in horizontal alignment, particularly where the alignment might be confusing, or at pavement width transitions. An important advantage of delineators, in certain areas, is that they remain visible when the roadway is wet or snow-covered.

3D-2 Design

Delineators shall consist of reflector units capable of clearly reflecting light under normal atmospheric conditions from a distance of 1,000 feet when illuminated by the upper beam of standard automobile lights. Reflective elements for delineators shall have a minimum dimension of approximately 3 inches. Elongated reflective units of appropriate size may be used in place of two reflectors mounted as a unit.

3D-3 Curb Markings for Delineation

Reflectorized solid yellow should be placed on the curbs of islands located in the line of traffic flow where the curb serves to channel traffic to the right of the obstruction. Reflectorized solid white should be used when traffic may pass on either side of the island.

Where the curbs of the islands become parallel to the direction of traffic flow it is not necessary to mark the curbs unless a study indicates the need for this type of delineation. Where these curbs are marked, the colors shall conform to the general principles of markings (sec. 3A-5).

Curbs at openings in a continuous median island need not be marked unless individual study indicates the need for this type of marking.

3D-4 Delineator Application

Delineation is intended to be a guide to the vehicle operator as to the alignment of the highway; whatever is needed to provide that guidance in a clear and simple way should be installed.

The color of delineators shall, in all cases, conform to the color of edgelines stipulated in section 3B-6.

Single delineators shall be provided on the right side of expressway and freeway roadways and on at least one side of interchange ramps. They may be provided on other classes of roads.

Single delineators may be provided on the left side of roadways and should be provided on the outside of curves on interchange ramps.

Where median crossovers are provided for official or emergency use on divided highways and where these crossovers are to be marked, a double yellow delineator should be placed on the left side of the through roadway on the far side of the crossover for each roadway.

Double or vertically elongated delineators should be installed at 100-foot intervals along acceleration and deceleration lanes.

Red delineators may be used on the reverse side of any delineator whenever it would be viewed by a motorist traveling in the wrong direction on that particular ramp or roadway.

Delineators of the appropriate color may be used to indicate the narrowing of the pavement where either an outside or inside lane merges into an adjacent lane. The delineators should be used adjacent to the lane affected for the full length of the convergence and should be so placed and spaced to show the width reduction (fig. 3-10, page 3B-13). Delineation is not necessary for the traffic moving in the direction of a wider pavement or on the side of the roadway where the alignment is not affected by the convergence. On a highway with continuous delineation on either or both sides, delineators should be carried through the transition and a closer spacing may be warranted.

Delineation shall be optional on sections of roadway between interchanges where fixed-source lighting is in operation.

When used, delineators shall be red in color and should normally be placed on both sides of truck escape ramps. The delineators should be spaced at 50 feet intervals for a distance sufficient to identify the ramp entrance. Delineator spacing beyond the ramp entrance should be adequate for guidance in accordance with the length and design of the escape ramp. III-24 (c) Rev. 3

3D-5 Delineator Placement and Spacing

Delineators, if used, shall be mounted on suitable supports so that the top of the reflecting head is about 4 feet above the near roadway edge. They shall be placed not less than 2 or more than 8 feet outside the outer edge of the shoulder, or if appropriate, in the line of the roadside barrier that is 8 feet or less outside the outer edge of the shoulder. III-21 (c) Rev. 3 Editorial Change Rev. 4

Delineators should be placed at a constant distance from the edge of the roadway except that, where a guardrail or other obstruction intrudes into the space between the pavement edge and the extension of the line of delineators, the delineators should be in line with or inside the innermost

edge of the obstruction. Typical delineator installations are shown in figure 3-20 (page 3C-4).

Normally, delineators should be spaced 200 to 528 feet. When normal uniform spacing is interrupted by driveways, cross roads, etc., delineators falling within such areas may be moved in either direction, a distance not exceeding one-quarter of the normal spacing. Delineators still falling within such areas should be eliminated.

Spacing should be adjusted on approaches and throughout horizontal curves so that several delineators are always visible to the driver. Table III-1 shows suggested spacing for delineators at horizontal curves.

Table III-1 Suggested Spacing for Highway Delineators on Horizontal Curves

(Distance in Feet Rounded to the Nearest 5 Feet)

Radius of Curve (in feet)	Spacing on Curve (in feet) (S)
50	20
150	30
200	35
250	40
300	50
400	55
500	65
600	70
700	75
800	80
900	85
1,000	90

Spacing for specific radii not shown may be interpolated from table. The minimum spacing should be 20 feet. The spacing on curves should not exceed 300 feet. In advance of or beyond a curve, and proceeding away from the end of the curve, the spacing of the first delineator is 2S, the second 3S, and the third 6S but not to exceed 300 feet. S refers to the delineator spacing for specific radii computed from the formula $S = 3\sqrt{R-50}$.

E. COLORED PAVEMENTS

3E-1 Colored Pavements

When used for guidance and regulation of traffic, colored pavement surfaces are traffic control devices. Situations occur where colored pavements could supplement other traffic control devices. They should be used only where they contrast significantly with adjoining paved areas. Where colored pavements are used, the guidance or control provided shall be applicable at all times.

3E-2 Colors

The use of the following colors for pavements shall be limited to the purposes noted:

1. Red shall be used only on the approaches to a STOP sign which is in use 24 hours a day. The length of colored surface should be related to the 85-percentile approach speed of traffic and give the driver a two to four second advance warning.
2. Yellow shall be used only for medians separating traffic flows in opposite directions.
3. White shall be used for delineation on shoulders, on channelizing islands where traffic passes on both sides in the same general direction, and for crosswalks.

F. BARRICADES AND CHANNELIZING DEVICES

3F-1 Barricades

Red and white barricades are to warn and alert drivers of the terminous of a road, street or highway in other than construction or maintenance areas. The barricades are to meet the design criteria of section 6C-8 for a Type III barricade, except the colors of the stripes shall be reflectorized white and reflectorized red. These devices may be used to mark any of the following type locations:

1. Roadway ends in a dead end or cul-de-sac with no outlet.
2. A ramp or lane closed for operational purposes.
3. The permanent or semipermanent closure or termination of a roadway.

3F-2 Channelizing Devices

Traffic cones and tubular markers are sometimes used outside of construction and maintenance areas for general traffic control purposes. Such uses include adding emphasis to reversible lane delineation, channelizing lines or islands.

These devices shall be a minimum of 18 inches in height and made of materials to withstand impact without damage to themselves or to vehicles. Large size devices should be used wherever more conspicuous guidance is needed.

The color of cones and tube markers used outside construction and maintenance areas shall be the same as the pavement marking which they supplement or for which they are substituted. They should be kept clean and bright for maximum target value. For nighttime use they shall be reflectorized.

Reflectorization of tubular markers shall be a minimum of two three-inch bands placed a maximum of 2″ from the top with a maximum of 6″ between the bands. Reflectorization of cones shall be provided by a minimum 6″ band placed a maximum of 3″ from the top. Reflectorized material shall have a smooth, sealed outer surface which will display the same approximate color day and night.

PART IV. SIGNALS

A. GENERAL

4A-1 Types

A highway traffic signal is any power-operated traffic control device, other than a barricade warning light or steady burning electric lamp, by which traffic is warned or directed to take some specific action.

The following types and uses of highway traffic signals are discussed in this part of the Manual: traffic control signals, pedestrian signals, beacons, lane-use control signals, traffic control at moveable bridges, priority control of traffic signals and traffic signals for one-lane, two-way facilities.

4A-2 Basis of Installation

In most cases the installation of a highway traffic signal will operate either to the advantage or disadvantage of the vehicles and persons controlled. A careful analysis of traffic operations and other factors at a large number of signalized and unsignalized intersections, coupled with the judgment of experienced engineers, have provided a series of warrants that define the minimum conditions under which signal installations may be justified. Consequently the selection and use of this control device should be preceded by a thorough engineering study of roadway and traffic conditions.

Engineering studies should be made of operating signals to determine if the type of installation and the timing program meet the current requirements of traffic.

4A-3 Definitions Relating to Signals

The following terms are used throughout Part IV:

1. Signal Face—that part of a highway traffic signal which controls one or more traffic movements in a single direction.

2. Signal Head—an assembly of one or more signal faces.

3. Signal Lens—that part of the optical unit which redirects the light coming directly from the light source and its reflector, if any.

4. Signal Indication—the illumination of a signal lens or equivalent device.

B. TRAFFIC CONTROL SIGNALS

4B-1 General Aspects

A traffic control signal (traffic signal) is a type of highway traffic signal by which traffic is alternately directed to stop and permitted to proceed.

Traffic control signals are sometimes described as either pretimed or traffic-actuated. Under pretimed control the red, green, and yellow intervals are predetermined. Under traffic-actuated control, these intervals are varied continuously according to traffic demands.

The features of traffic control signals in which vehicle operators and pedestrians are interested are the location, design, indications, and legal significance of the signals. These are identical for all types of traffic control signals. Uniformity in the design features that affect the traffic to be controlled (as set forth in this Manual) is especially important for safe and efficient traffic operations.

Special police supervision and/or enforcement should be provided for a new non-intersection location.

4B-2 Area of Control

A traffic control signal shall control traffic only at the intersection or mid-block location where the installation is placed.

4B-3 Advantages and Disadvantages of Traffic Control Signals

Traffic control signals are valuable devices for the control of vehicle and pedestrian traffic. However, because they assign the right-of-way to the various traffic movements, traffic signals exert a profound influence on traffic flow.

Traffic control signals, properly located and operated, usually have one or more of the following advantages:

1. They can provide for the orderly movement of traffic.
2. Where proper physical layouts and control measures are used, they can increase the traffic-handling capacity of the intersection.
3. They can reduce the frequency of certain types of accidents, especially the right-angle type.
4. Under favorable conditions, they can be coordinated to provide for continuous or nearly continuous movement of traffic at a definite speed along a given route.
5. They can be used to interrupt heavy traffic at intervals to permit other traffic, vehicular or pedestrian, to cross.

Many laymen believe that traffic signals provide the solution to all traffic problems at intersections. This has led to their installation at a large number of locations where no legitimate factual warrant exists.

Traffic signal installations, even though warranted by traffic and roadway conditions, can be illdesigned, ineffectively placed, improperly operated, or poorly maintained. The following factors can result from improper or unwarranted signal installations:

1. Excessive delay may be caused.
2. Disobedience of the signal indications is encouraged.
3. The use of less adequate routes may be induced in an attempt to avoid such signals.
4. Accident frequency (especially the rear-end type) can be significantly increased.

4B-4 Portable Traffic Control Signals

A portable traffic control signal must meet the physical display and operational requirements of conventional traffic signals described herein. A portable traffic control signal should normally not operate longer than 30 days unless associated with a construction or maintenance project, in which case it shall be removed when no longer needed on the project. It is desirable to use advance signing when employing this device. A portable traffic control signal should be used only when an engineering study so indicates.

4B-5 Meaning of Signal Indications

Unless otherwise determined by law, the following meanings shall be given to highway traffic signal indications, except those on pedestrian signals:

1. Green indications shall have the following meanings:

(a) Traffic, except pedestrians, facing a CIRCULAR GREEN may proceed straight through or turn right or left except as such movement is modified by lane-use signs, turn prohibition signs, lane markings, or roadway design. But, vehicular traffic, including vehicles turning right or left, shall yield the right-of-way to other vehicles, and to pedestrians lawfully within the intersection or an adjacent crosswalk, at the time such signal indication is exhibited.

(b) Traffic, except pedestrians, facing a GREEN ARROW, shown alone or in combination with another indication, may cautiously enter the intersection only to make the movement indicated by such arrow, or such other movement as is permitted by other indications shown at the same time. Such vehicular traffic shall yield the right-of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic lawfully using the intersection.

(c) Unless otherwise directed by a pedestrian signal, pedestrians facing any green indication, except when the sole green indication is a turn arrow, may proceed across the roadway within any marked or unmarked crosswalk.

2. Steady yellow indications shall have the following meanings:

(a) Traffic, except pedestrians, facing a steady CIRCULAR YELLOW or YELLOW ARROW signal is thereby warned that the related green movement is being terminated or that a red indication will be exhibited immediately thereafter when vehicular traffic shall not enter the intersection.

(b) Pedestrians facing a steady CIRCULAR YELLOW or YELLOW ARROW signal, unless otherwise directed by a pedestrian signal, are thereby advised that there is insufficient time to cross the roadway before a red indication is shown and no pedestrian shall then start to cross the roadway.

3. Steady red indications shall have the following meanings:

(a) Vehicular traffic facing a steady CIRCULAR RED signal alone shall stop at a clearly marked stop line, but if none, before entering the crosswalk on the near side of the intersection, or if none, then before entering the intersection and shall remain standing until an indication to proceed is shown except as provided in (c) below.

(b) Vehicular traffic facing a steady RED ARROW signal shall not enter the intersection to make the movement indicated by the arrow and, unless entering the intersection to make a movement permitted by another signal, shall stop at a clearly marked stop line, but if none, before entering the crosswalk on the near side of the intersection, or if none, then before entering the intersection and shall remain standing until an indication permitting the movement indicated by such red arrow is shown except as provided in (c) below.

(c) Except when a sign is in place prohibiting a turn, vehicular traffic facing any steady red signal may cautiously enter the intersection to turn right, or to turn left from a one-way street into a one-way street, after stopping as required by (a) and (b) above. Such vehicular traffic shall yield the right-of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic lawfully using the intersection.

(d) Unless otherwise directed by a pedestrian signal, pedestrians facing a steady CIRCULAR RED or RED ARROW signal alone shall enter the roadway.

4. Flashing signal indications shall have the following meanings:

(a) Flashing red (stop signal)—When a red lens is illuminated with rapid intermittent flashes, drivers of vehicles shall stop at a clearly marked stop line, but if none, before entering the crosswalk on the near side of the intersection, or if none, at the point nearest the intersecting roadway where the driver has a view of approaching traffic on the intersecting roadway before entering the intersection, and the right to proceed shall be subject to the rules applicable after making a stop at a STOP sign.

(b) Flashing yellow (caution signal)—When a yellow lens is illuminated with rapid intermittent flashes, drivers of vehicles may proceed through the intersection or past such signal only with caution.

4B-6 Application of Signal Indications

Basic displays used in signal operations are the steady CIRCULAR RED, CIRCULAR YELLOW, or CIRCULAR GREEN indication, used on each of the approaches. The application for these signal indications shall be as follows:

1. A steady CIRCULAR RED indication:

(a) Shall be given when it is intended to prohibit traffic, except pedestrians directed by a pedestrian signal, from entering the intersection or other controlled area. (See sec. 4B-5(3)(c).)

(b) Should be displayed with the appropriate green arrow indications when it is intended to permit traffic to make a specified turn or turns, and to prohibit traffic from proceeding straight ahead through the controlled area. This display is not required where it is physically impossible for traffic to go straight ahead, as at the head of a "T" intersection.

2. A steady CIRCULAR YELLOW indication:

(a) Shall be given following a CIRCULAR GREEN indication in the same signal face, except if the signal face controls an exclusive left turn lane and the CIRCULAR GREEN indication is to be followed by a GREEN ARROW indication.

(b) Is an optional alternative to a yellow arrow indication following a green arrow indication in a separate signal face used exclusively to control a single directional movement.

3. A steady CIRCULAR GREEN indication shall be given only when it is intended to permit traffic to proceed in any direction which is lawful and practical.

4. Steady RED ARROW, YELLOW ARROW and GREEN ARROW indications may be used in lieu of the corresponding circular indications at the following locations:

(a) On an approach intersecting a one-way street.

(b) Where certain movements are prohibited.

(c) Where certain movements are physically impossible.

(d) On an intersection approach which has an exclusive lane for turning movements.

(e) Where turning movements are "protected" from conflicting movements by other indications or by the signal sequence.

(f) Where all the movements on the approach do not begin or end at the same time and where the indications for the turning movements will also be visible to traffic with other allowable movements.

5. Steady arrow indications are used as follows:

(a) A steady YELLOW ARROW indication shall be used following a GREEN ARROW indication which has been displayed simultaneously with a CIRCULAR RED indication in the same signal face. A GREEN ARROW need not be terminated by a displayed interval if a CIRCULAR GREEN permitting the turn to continue on a permissive basis is displayed in the same signal face simultaneously with the GREEN ARROW or immediately following the GREEN ARROW termination.

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(b) A steady YELLOW ARROW indication or optional CIRCULAR YELLOW shall follow a GREEN ARROW indication in a signal face which is used exclusively to control a single directional movement.

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(c) A steady YELLOW ARROW indication may be used to indicate the clearance interval following the termination of a GREEN ARROW indication which has been displayed simultaneously with a continuing CIRCULAR GREEN indication in the same signal face.

(d) A steady GREEN ARROW indication shall be used only to allow vehicular movements which are completely protected from conflict with other vehicles moving on a green or yellow indication or with pedestrians crossing in conformance with a WALK or flashing DONT WALK indication.

(e) A steady left GREEN ARROW indication shall be used as the green display on a signal face which controls an exclusive left turn lane, if that left turn movement is protected by the signal sequence.

(f) A YELLOW ARROW shall not be displayed when any conflicting movement has a CIRCULAR GREEN or CIRCULAR YELLOW.

6. The following combinations of signal indications shall not be simultaneously displayed on any one signal face:

(a) CIRCULAR GREEN with CIRCULAR YELLOW
(b) Straight-through GREEN ARROW with CIRCULAR RED.
(c) CIRCULAR RED with CIRCULAR YELLOW.
(d) CIRCULAR GREEN with CIRCULAR RED.

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The above combinations shall not be simultaneously displayed in different signal faces on any one approach unless:

(a) One of the faces is a turn signal controlling only an exclusive turn lane and a sign LEFT (or RIGHT) TURN SIGNAL (sec. 4B-12(3)) is located adjacent to each such signal face.

(b) One of the faces is a turn signal controlling only an exclusive turn lane and consists entirely of arrow indications.

(c) The signal faces are shielded, hooded, louvered, positioned or designed so that the combination is not confusing to approaching drivers.

The following signal indications shall not be displayed on any signal face, either alone, or in combination with any other indication:

(a) Straight-through RED ARROW

(b) Straight-through YELLOW ARROW

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7. When a traffic control signal is put on flashing operation, normally a yellow indication should be used for the major street and a red indication for the other approaches. Yellow indications shall not be used for all approaches. The following applications shall apply whenever signals are placed in flashing operation:

(a) A CIRCULAR YELLOW indication shall be flashed instead of any YELLOW ARROW indication which may be included in that signal face.

(b) No CIRCULAR GREEN or GREEN ARROW indication or flashing yellow indication shall be terminated and immediately followed by a steady red or flashing red indication without the display of the steady yellow change indication; however, transition may be made directly from a CIRCULAR GREEN or GREEN ARROW indication to a flashing yellow indication.

(c) All signal faces on an approach shall flash the same color of circular indication, except that left turn signal indications may be flashed CIRCULAR RED when adequately shielded or positioned so that through traffic on the approach will not be exposed to substantial visual conflict from the left turn signal indications. The flashing yellow signal indication for through traffic does not have to be shielded or positioned to prevent visual conflict for drivers in the left turn lane.

4B-7 Number of Lenses per Signal Face

Each signal face, except in pedestrian signals, shall have at least three lenses, but not more than five. The lenses shall be red, yellow or green in color, and shall give a circular or arrow type of indication. Allowable exceptions to the above are:

1. Where a single section green arrow lens is used alone to indicate a continuous movement.
2. As discussed under Unexpected Conflicts During Green or Yellow Interval (sec. 4B-16). IV-27 (c) Rev. 3
3. Where one or more indications are repeated for reasons of safety or impact.
4. Where a variable indication signal section is used to display alternately a green arrow and a yellow arrow.

4B-8 Size and Design of Signal Lenses

The aspect of all signal lenses, except in pedestrian signals, shall be circular. There shall be two sizes for lenses, 8 inches and 12 inches nominal diameter.

Different sizes of lenses may be used in the same signal head except that an 8-inch red indication shall not be used in combination with 12-inch CIRCULAR GREEN or 12-inch CIRCULAR YELLOW indications.

1. Twelve inch lenses shall be used:

(a) For signal indications for approaches* where drivers view both traffic control and lane use control signals simultaneously.

(b) Where the nearest signal face is between 120 feet and 150 feet beyond the stop line, unless a supplemental near side signal indication is used.

(c) For signal indications located more than 150 feet from the stop line (also see 4B-12.9).

2. Twelve-inch lenses shall be used for all signal approaches for which the minimum visibility distance requirements of Section 4B-12.1 cannot be met.

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3. Twelve-inch lenses should be used for all signal indications for:

(a) Approaches with 85 percentile approach speeds exceeding 40 mph.

(b) Approaches where signalization might be unexpected.

(c) Arrows.

(d) All approaches with rural cross sections where only post mounted signals are used.

4. Twelve-inch lenses, or 12-inch red lenses, may be used for approaches where an engineering study indicates a need for extra visibility or target value.

Arrows shall be pointed vertically upward to indicate a straight-through movement and in a horizontal direction to indicate a turn at approximately right angles. When the angle of the turn is substantially different from a right angle, the arrow should be positioned on an upward slope at an angle approximately equal to that of the turn.

Each arrow lens shall show only one arrow direction. The alternate display of two arrow indications in the same lens, a green arrow or a yellow arrow, shall be permitted. The arrow shall be the only illuminated part of the lens visible.

In no case shall letters or numbers be displayed as part of a vehicular signal indication.

Except for the requirements of this section, all lenses shall conform to the Vehicle Traffic Control Signal Head Equipment Standards.**

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*Approach definition: all lanes of traffic moving toward a location from one direction.

** Available from the Institute of Transportation Engineers, see page iv.

4B-9 Arrangement of Lenses in Signal Faces

The lenses in a signal face shall be arranged in a vertical or horizontal straight line, except that in a vertical array, lenses of the same color may be arranged horizontally adjacent to each other at right angles to the basic straight line arrangement (fig. 4-1). Such clusters shall be limited to two identical lenses or to two or three different lenses of the same color.

In each signal face, all red lenses in vertical signals shall be located above, and in horizontal signals shall be located to the left of all yellow and green lenses.

A CIRCULAR YELLOW lens shall be located between the red lens or lenses and all other lenses.

In vertically arranged signal faces, each YELLOW ARROW lens shall be located immediately above the GREEN ARROW lens to which it applies. When a variable indication arrow lens (capable of showing either a green or a yellow arrow) is used, the lenses shall be in the same position relative to other lenses as are the GREEN ARROW lenses in a vertical signal face.

In horizontally arranged signals, the YELLOW ARROW lens shall be located immediately to the left of the GREEN ARROW lens. When a variable indication arrow lens (a green arrow and a yellow arrow) is used, the LEFT TURN ARROW lens shall be located immediately to the right of the CIRCULAR YELLOW lens, the STRAIGHT THROUGH ARROW lens shall be located immediately to the right of the CIRCULAR GREEN lens, and the RIGHT TURN ARROW lens shall be located to the right of all other lenses.

The relative positions of lenses within the signal face shall be as follows:

1. In a vertical signal face from top to bottom:

CIRCULAR RED
Left turn RED ARROW
Right turn RED ARROW
CIRCULAR YELLOW
CIRCULAR GREEN
Straight through GREEN ARROW
Left turn YELLOW ARROW
Left turn GREEN ARROW
Right turn YELLOW ARROW
Right turn GREEN ARROW

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The location of the CIRCULAR GREEN below the Straight Through GREEN ARROW is an acceptable alternative, although the position of the CIRCULAR GREEN shown in the above tabulation is preferred.

2. In a horizontal signal face from left to right:

CIRCULAR RED
Left turn RED ARROW

Right turn RED ARROW
CIRCULAR YELLOW
Left turn YELLOW ARROW
Left turn GREEN ARROW
CIRCULAR GREEN
Straight through GREEN ARROW
Right turn YELLOW ARROW
Right turn GREEN ARROW

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3. In a cluster, identical signal indications may be repeated in adjacent vertical or horizontal locations within the same signal face. If adjacent indications in a cluster are not identical, their arrangement shall follow paragraph 1 or 2 above, as applicable.

Basic horizontal and vertical display faces may be used on the same approach provided they are separated to meet the lateral clearance required in section 4B-12.

Figure 4-1 shows more possible arrangements of lenses in signal faces.

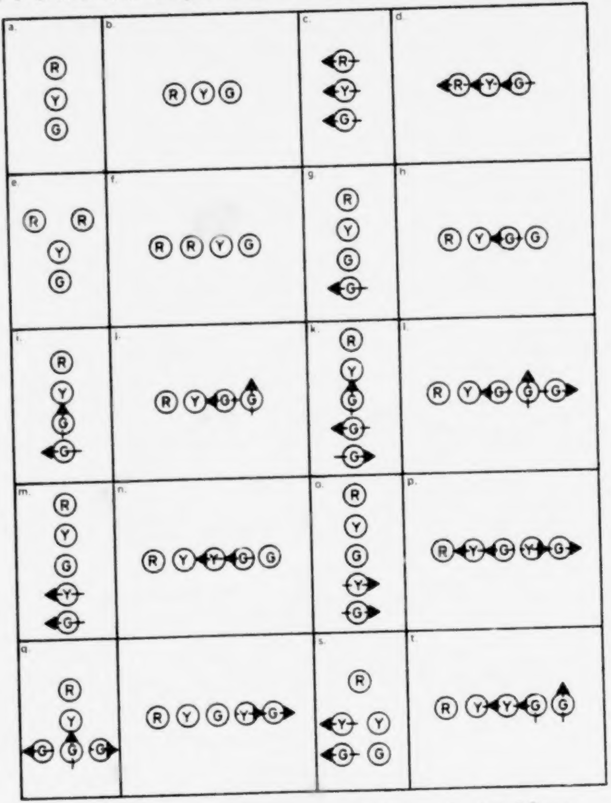

Figure 4-1. Typical arrangements of lenses in signal faces.

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4B-10 Illumination of Lenses

Each signal lens shall be illuminated independently.

The intensity and distribution of light from each illuminated signal lens should conform to the current editions of Vehicle Traffic Control Signal Head Equipment Standards *, and A Standard for Traffic Signal Lamps *. IV-42 (c) Rev. 4

When 12-inch signals with 150 watt lamps are placed on flashing for nighttime operation and the flashing yellow indication is so bright as to cause excessive glare, an automatic dimming device should be used to reduce the brilliance of the flashing 12-inch yellow.

4B-11 Visibility and Shielding of Signal Faces

Each signal face shall be so adjusted that its indications will be of maximum effectiveness to the approaching traffic for which they are intended.

Visors should be used on all signal faces to aid in directing the signal indication specifically to approaching traffic, as well as to reduce "sun phantom" resulting from external light entering the lens. A back-plate is a strip of thin material which extends outward parallel to the signal face, on all sides of the signal housing to increase the signal target value. Target value enhancement should be used on signals viewed against a sky or bright or confusing background.

In general, vehicular signal faces should be aimed so that the continuation of the optical axis of the signal passes through a point on the approach, which is located at least the mininum visibility distance from the stop line (specified in Section 4B-12.1) and at drivers eye height. If the approach sight distance is limited by horizontal or vertical alignment, the signals shall be aimed at a point on the approach at which the signal indication first becomes visible. IV-42 (c) Rev. 4

Irregular street design frequently necessitates placing signals for different street approaches with a comparatively small angle between their indications. In these cases, each signal indication shall, to the extent practicable, be shielded or directed by visors, louvers, or other means so that an approaching driver can see only the indication controlling his movement. Tunnel visors exceeding 12 inches in length shall not be used on free-swinging signals.

The use of visors, or the use of signals or devices which direct the light without a reduction in intensity should be considered as an alternative to louvers due to the reduction in light output caused by louvers. IV-42 (c) Rev. 4

The foregoing does not preclude the use of special signal faces such that the driver does not see their indications before seeing other indications, when simultaneous viewing of both signal indications could cause the driver to be misdirected.

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* Available from the Institute of Transportation Engineers, see page iv.

4B-12 Number and Location of Signal Faces

The primary consideration in signal face placement shall be visibility. Drivers approaching a signalized intersection or other signalized area, such as a mid-block crosswalk, shall be given a clear and unmistakable indication of their right-of-way assignment. Critical elements are lateral and vertical angles of sight toward a signal face, as determined by typical driver eye position, vehicle design, and the vertical, longitudinal and lateral position of the signal face. The geometry of each intersection to be signalized, including vertical grades, horizontal curves, and obstructions should be considered in signal face placement.

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The visibility, location and number of signal faces for each approach to an intersection of a mid-block crosswalk shall be as follows:

1. For through traffic, a minimum of two signal faces shall be provided, and should be visible to traffic approaching the signals, from a point at least the following "minimum visibility distance" indicated in Table 4-1, continuously, until the traffic reaches the stop line. This range of continuous visibility should be provided unless precluded by a physical obstruction or there is another signalized intersection within this range.

Table 4-1

85 Percentile Speed (mph)	*Minimum Visibility Distance (ft.)*
20	175
25	215
30	270
35	325
40	390
45	460
50	540
55	625
60	715

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2. Where the visibility requirements in Table 4-1 cannot be met, a suitable sign shall be erected to warn approaching traffic. Such sign may be supplemented by a Hazard Identification Beacon (Section 4E-1), if drivers do not have a continuous view of at least one signal indication for the minimum visibility distance. A beacon used in this manner may be interconnected with the traffic signal controller in such a manner as to flash yellow during the period when drivers passing this beacon, at the legal speed for the roadway, may encounter a red signal upon arrival at the signalized location.

3. Where a turn signal is operated in the protected turn mode only, at least one signal face is required for the control of a single turn lane. Such a

signal face shall be in addition to the minimum of two signal faces for through-traffic. When the indications of a separate signal face or faces controlling only an exclusive turn lane will also be visible to traffic with other allowable movements, a sign LEFT (or RIGHT) TURN SIGNAL (sec. 2B-37) shall be located adjacent to each such signal face. When the face consists entirely of arrow indications, such a sign is not required. If two or more lanes are provided for the separately controlled turn movement, or if the turn movement represents the major movement from the approach, two signal faces should be provided.

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4. Except where the width of the intersecting street or other conditions make it physically impractical, at least one and preferably both of the signal faces required by paragraph (1) above shall be located not less than 40 feet nor more than 120 feet beyond the stop line. Where both of the signal faces required by paragraph (1) above are post-mounted, they shall both be on the far side of the intersection, one on the right and one on the left of the driver. The signal faces required by paragraph (3) above shall conform to the same location requirements as the signal faces required by paragraph (1) to the extent practical.

5. Except where the width of the intersecting street or other conditions make it physically impractical, at least one and preferably both of the signal faces required by paragraph (1) above shall be located between two lines intersecting with the center of the approach lanes at the stop line, one making an angle of approximately 20 degrees to the right of the center

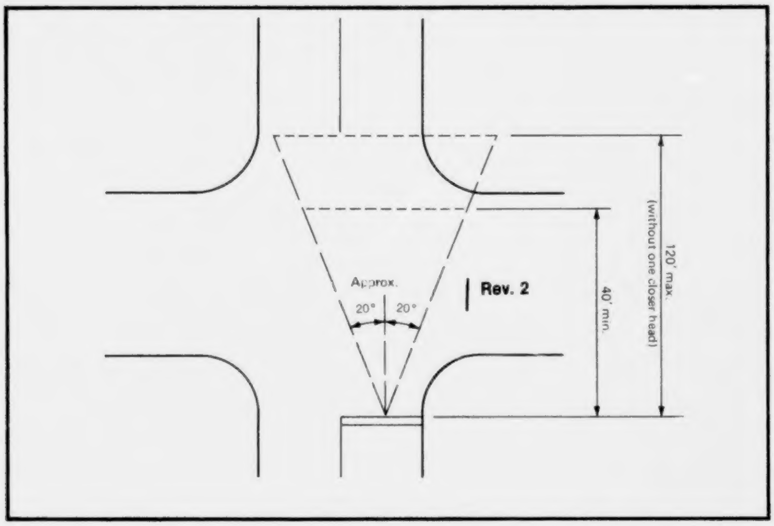

Figure 4-2. Desirable location of signal faces.

of the approach extended, and the other making an angle of approximately 20 degrees to the left of the center of the approach extended (fig. 4-2). This requirement is to be applied simultaneously with paragraph (4) above.

6. Near-side signals should be located as near as practicable to the stop line.

7. Where a signal face controls a specific lane or lanes of approach, its position should make it readily visible to drivers making that movement. IV-42(c) Rev. 4

8. Required signal faces for any one approach shall be not less than 8 feet apart measured horizontally between centers of faces.

9. Where the nearest signal face is 150 feet or more beyond the stop line, a supplemental near-side signal face shall be used. IV-42(c) Rev. 4

10. A signal face mounted on a span wire or mast arm should be located as near as practicable to the line of the driver's normal view.

11. Supplemental signal faces should be used when an engineering study has shown that they are needed to achieve both advance and immediate intersection visibility. When used, they should be located to provide optimum visibility for the movement to be controlled. The following limitations apply:

(a) Left turn arrows shall not be used in near-right faces.

(b) Right turn arrows shall not be used in far-left faces. A far-side median mount signal shall be considered as a far-left signal for this application.

At signalized mid-block crosswalks, there should be at least one signal face over the traveled roadway for each approach. In other respects, a traffic control signal at a mid-block location shall meet the requirements set forth herein.

The transverse location of a signal face, shall, if mounted on the top of a post or on a short bracket from it, conform with section 4B-14.

Supplementary pedestrian signals shall be used where warranted as provided in section 4D-3.

If a signal face(s) displays control for a particular vehicular movement during any interval of a sequence, it must display control for that same movement during all intervals of the sequence. IV-27 (c) Rev. 3

4B-13 Height of Signal Faces

The bottom of the housing of a signal face, not mounted over a roadway, shall not be less than 8 feet nor more than 15 feet above the sidewalk or, if none, above the pavement grade at the center of the highway, except that the bottom of center median, near-side signal faces may be mounted at a minimum of 4½ feet above the median island grade.

The bottom of the housing of a signal face suspended over a roadway shall not be less than 15 feet nor more than 19 feet above the pavement grade at the center of the roadway.

Within the above limits, optimum visibility and adequate clearance should be the guiding considerations in deciding signal height. Grades on approaching streets may be important factors, and should be considered in determining the most appropriate height.

4B-14 Transverse Location of Traffic Signal Supports and Controller Cabinets

In the placement of signal supports, primary consideration shall be given to ensuring the proper visibility of signal faces as described in sections 4B-12 and 13. However, in the interest of safety, signal supports and controller cabinets should be placed as far as practicable from the edge of the traveled way without adversely affecting signal visibility.

Supports for post-mounted signal heads at the side of a street with curbs shall have a horizontal clearance of not less than 2 feet from the face of a vertical curb. Where there is no curb, supports for post-mounted signal heads shall have a horizontal clearance of not less than 2 feet from the edge of a shoulder, within the limits of normal vertical clearance. A signal support should not obstruct a crosswalk.

No part of a concrete base for a signal support should extend more than 4 inches above the ground level at any point, except that this limitation does not apply to the concrete base for a rigid (non-breakaway) support.

On medians, the above minimum clearances for signal supports should be obtained where practicable. Any supports which cannot be located with the required clearances should be of the breakaway type or should be guarded if at all practicable.

4B-15 Vehicle Change Interval

A yellow vehicle change interval shall be used, where applicable, following each CIRCULAR GREEN or GREEN ARROW interval, as discussed in section 4B-6(2) and (4). In no case shall a CIRCULAR YELLOW indication be displayed in conjunction with the change from CIRCULAR RED to CIRCULAR GREEN.

The exclusive function of the steady yellow interval shall be to warn traffic of an impending change in the right-of-way assignment.

Yellow vehicle change intervals should have a range of approximately 3 to 6 seconds. Generally the longer intervals are appropriate to higher approach speeds.

The yellow vehicle change interval may be followed by a short all-way red clearance interval, of sufficient duration to permit the intersection to clear before cross traffic is released.

A clearance interval shall be provided between the termination of a GREEN ARROW indication and the showing of a green indication to any conflicting traffic movement.

A YELLOW ARROW shall not be terminated by a GREEN ARROW. It may be terminated by a CIRCULAR GREEN if the movement controlled by the arrow is to continue on a permissive basis, or by a CIRCULAR YELLOW, CIRCULAR RED, or RED ARROW.

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4B-16 Unexpected Conflicts During Green or Yellow Interval

No movement that may involve an unexpected crossing of pathways of moving traffic should be indicated during any green or yellow interval, except when:

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1. The movement involves only slight hazard;

2. Serious traffic delays are materially reduced by permitting the conflicting movement; and

3. Drivers and pedestrians subjected to the unexpected conflict are effectively warned thereof.

When such conditions of possible unexpected conflict exist, warning may be given by a sign or by the use of an appropriate signal indication as set forth in section 4B-7. The foregoing applies to vehicle-pedestrian conflicts as well as to vehicle-vehicle conflicts.

4B-17 Coordination of Traffic Control Signals

Traffic control signals within ½ mile of one another along a major route or in a network of intersecting major routes should be operated in coordination, preferably with interconnected controllers. However, coordination need not be maintained across boundaries between signal systems which operate on different time cycles. Coordinated operation normally should include both pre-timed signals and traffic-actuated signals within the appropriate distances.

For coordination with railroad grade crossings signals see section 8C-6.

4B-18 Flashing Operation of Traffic Control Signals

All traffic signal installations shall be provided with an electrical flashing mechanism supplementary to the signal timer. A manual switch, or where appropriate, automatic means, shall be provided to actuate the flashing mechanism. The signal timer shall be removable without affecting the flashing operation. The mechanism shall operate in a manner similar to that of an Intersection Control Beacon (sec. 4E-3) to provide intermittent illumination of selected signal lenses.

The illuminating element in a flashing signal shall be flashed continuously at a rate of not less than 50 nor more than 60 times per minute. The illuminated period of each flash shall be not less than half and not more than two-thirds of the total flash cycle.

When traffic control signals are put on flashing operation, the signal indications given to the several streets shall be as specified in section 4B-6(7).

Automatic changes from flashing to stop-and-go operation shall be made at the beginning of the major street green interval, preferably at the beginning of the common major street green interval, (i.e., when a green indication is shown in both directions on the major street). Automatic changes from stop-and-go to flashing operation shall be made at the end of the common major street red interval, (i.e., when a red indication is shown in both directions on the major street).

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The change from the flashing to stop-and-go operation, or from stop-and-go to flashing operation by manual switch may be made at any time.

Where there is no common major street green interval, the automatic change from flashing to stop-and-go operation shall be made at the beginning of the green interval for the major traffic movement on the major street. It may be necessary to provide a short, steady all-red interval for the other approaches before changing from flashing yellow or flashing red to green on the major approach.

4B-19 Continuity of Operation

A traffic signal installation, except as provided below, shall be operated as a stop-and-go device or as a flashing device.

When a signal installation is not in operation, such as prior to placing it in service, during seasonal shutdowns, or when it is not desirable to operate the signals, they should be hooded, turned or taken down to clearly indicate that the signal is not in operation.

When a traffic signal installation is being operated in the usual (stop-and-go) manner, at least one indication in each signal face shall be illuminated.

When a traffic signal is being operated as a flashing device, all signal faces on an approach shall be flashed.

The above provisions do not apply to emergency traffic signals, movable bridge signals or ramp control signals.

When a single-section, continuously illuminated GREEN ARROW lens is used alone to indicate a continuous movement, it may be continuously illuminated when the other signal indications in the signal installation are flashed.

4B-20 Signal Operation Must Relate to Traffic Flow

Traffic control signals shall be operated in a manner consistent with traffic requirements. Data from engineering studies shall be used to determine the proper phasing and timing for a signal.

Since traffic flows and patterns change, it is necessary that the engineering data be updated and re-evaluated regularly.

To assure that the approved operating pattern including timing is displayed to the driver, regular checks including the use of accurate timing devices should be made.

4B-21 Traffic Signals Near Grade Crossings

When a railroad-highway grade crossing with active traffic control devices is within or near a highway intersection controlled by traffic control signals, the two signal systems should be interconnected as provided in section 8C-6.

4B-22 Priority Control of Traffic Signals

Traffic control signals may be modified in timing, sequence, or display to grant priority control to authorized special classes of vehicles, (such as emergency, transit, construction, trains, boats, etc.). When the display of a traffic control signal is modified to grant priority control, change or clearance intervals shall be provided (4B-15, 4D-7). A distinctive indication may be provided at the intersection to show that an emergency vehicle has achieved control of the traffic signal (Uniform Vehicle Code 11-106).

Priority control of traffic signals may also be applicable in specialized nonintersection locations as a means of assigning priority right-of-way to specified classes of vehicles (such as on the approaches to one-lane bridges and tunnels, drawbridges, highway maintenance and construction activities, metered freeway entrance ramps, and transit operations).

Traffic signals operating under priority assignment should be operated in a manner designed to keep traffic moving. Prolonged all-red or flashing signal sequences are to be avoided.

When a priority sequence is initiated, the display may proceed from steady yellow to steady green. This exception does not apply to the termination of priority or to any display during priority operation. IV-27 (c) Rev. 3

4B-23 Maintenance of Traffic Control Signals

Prior to the installation of any traffic control signal, the responsibility for its maintenance should be clearly established. The responsible agency should provide for the maintenance of the signal and all of its appurtenances in a responsible manner. To this end the agency should:

1. Provide for alternate operation of the signal during a period of failure, either on flash or manually, or by having manual traffic direction by proper authority as may be warranted by traffic volumes or congestion, or by erecting other traffic control devices.
2. Have properly skilled maintenance available without undue delay for all emergency calls, including lamp failures.
3. Provide properly skilled maintenance for all components.
4. Maintain the appearance of the installation in a manner consistent with the intention of this Manual, with particular emphasis on painting and on cleaning of the optical system.

5. Service equipment and lamps as frequently as experience proves necessary to prevent undue failures.

6. Provide adequate stand-by equipment to minimize the interruption of signal operation due to equipment failure.

Every controller should be kept in effective operation in strict accordance with its predetermined timing schedule.

A careful check of the correctness of time operation of the controller should be made frequently enough to insure its operating in accordance with the planned timing schedule. Timing changes should be made only by authorized persons. A written record should be made of all timing changes.

Controllers should be carefully cleaned and serviced at least as frequently as specified by the manufacturer and more frequently if experience proves it necessary.

4B-24 Painting

The insides of visors (hoods) and the entire surface of louvers, and fins, and the front surface of backplates shall have a dull black finish to minimize light reflection to the side of the signals.

To obtain the best possible contrast with the visual background, it is desirable to paint signal head housings highway yellow.

4B-25 Vehicle Detectors

The placement of vehicle detectors in the roadway in relation to the Stop line is a very important factor in the proper operation of traffic-actuated signals and should be a factor in signal design.

Where the total entering traffic on one street is more than twice that on the cross street, detectors on the cross street should be placed closer to the stop line than on the main street.

Additional "ceiling" detectors may be required on lower volume streets to handle traffic entering the street from driveways between the basic detector and the Stop line.

The transverse placement of detectors should be such that vehicles traveling away from the intersection do not register "false-calls." On narrow two-way roadways this may require use of directional detectors.

4B-26 Auxiliary Signs

Signal instruction signs (sec. 2B-37) used with traffic signals should be located adjacent to the signal face to which they apply. Minimum clearance of the total assembly shall conform to the provisions of sections 2A-23 and 4B-13.

Stop signs shall not be used in conjunction with any signal operation, except:

1. When the indication flashes red at all times or

2. When a minor street or driveway is located within or adjacent to the controlled area, but does not warrant separate signal control due to extremely low potential for conflict.

When used in conjunction with traffic signals, illuminated signs shall be designed and mounted in such a manner as to avoid glare and reflections that seriously detract from the signal indications. The traffic control signal shall be given dominant position and brightness to assure its target priority in the overall display.

Traffic Signal Speed signs (sec. 2D-48) may be used to inform drivers of the speed of progression in effect on streets in the signal system.

4B-27 Removal of Confusing Advertising Lights

There should be legal authority to prohibit the display of any unauthorized sign, signal, marking, or device which interferes with the effectiveness of any official traffic control device. Specific reference is made to Section 11-205, Uniform Vehicle Code (1968, Supp. II 1976).

C. WARRANTS

4C-1 Advance Engineering Data Required

A comprehensive investigation of traffic conditions and physical characteristics of the location is required to determine the necessity for a signal installation and to furnish necessary data for the proper design and operation of a signal that is found to be warranted. Such data desirably should include:

1. The number of vehicles entering the intersection in each hour from each approach during 16 consecutive hours of a representative day. The 16 hours selected should contain the greatest percentage of the 24-hour traffic.

2. Vehicular volumes for each traffic movement from each approach, classified by vehicle type (heavy trucks, passenger cars and light trucks, and public-transit vehicles), during each 15-minute period of the two hours in the morning and of the two hours in the afternoon during which total traffic entering the intersection is greatest.

3. Pedestrian volume counts on each crosswalk during the same periods as the vehicular counts in paragraph (2) above and also during hours of highest pedestrian volume. Where young or elderly persons need special consideration, the pedestrians may be classified by general observation and recorded by age groups as follows:

   (a) under 13 years
   (b) 13 to 60 years
   (c) over 60 years.

4. The 85-percentile speed of all vehicles on the uncontrolled approaches to the location.

5. A conditions diagram showing details of the physical layout, including such features as intersectional geometrics, channelization, grades, sight-distance restrictions, bus stops and routings, parking conditions, pavement markings, street lighting, driveways, location of nearby railroad crossings, distance to nearest signals, utility poles and fixtures, and adjacent land use.

6. A collision diagram showing accident experience by type, location, direction of movement, severity, time of day, date, and day of week for at least one year.

The following data are also desirable for a more precise understanding of the operation of the intersection and may be obtained during the periods specified in (2) above:

1. Vehicle-seconds delay determined separately for each approach.

2. The number and distribution of gaps in vehicular traffic on the major street when minor-street traffic finds it possible to use the intersection safely.

3. The 85-percentile speed of vehicles on controlled approaches at a point near to the intersection but unaffected by the control.

4. Pedestrian delay time for at least two 30-minute peak pedestrian delay periods of an average weekday or like periods of a Saturday or a Sunday.

Adequate roadway capacity at a signalized intersection is desirable. Widening of both the main highway and the intersecting roadway may be warranted to reduce the delays caused by assignment of right-of-way at intersections controlled by traffic signals. Widening of the intersecting roadway is often beneficial to operation on the main highway because it reduces the signal time that must be assigned to side-street traffic. In urban areas, the effect of widening can be achieved by elimination of parking at intersectional approaches. It is always desirable to have at least two lanes for moving traffic on each approach to a signalized intersection. Additional width may be necessary on the leaving side of the intersection, as well as the approach side, in order to clear traffic through the intersection effectively. Before an intersection is widened, the additional green time needed by pedestrians to cross the widened streets should be checked to ensure that it will not exceed the green time saved through improved vehicular flow.

4C-2 Warrants for Traffic Signal Installation

Traffic control signals should not be installed unless one or more of the signal warrants in this Manual are met. Information should be obtained by means of engineering studies and compared with the requirements set forth in the warrants. If these requirements are not met, a traffic signal should neither be put into operation nor continued in operation (if already installed).

For the purpose of warranting signalization, a wide-median intersection should be considered as one intersection.

When a traffic control signal is indicated as being warranted, it is presumed that the signal and all related traffic control devices and markings are installed according to the standards set forth in this Manual. It is further presumed that signal indications are properly phased, that roadways are properly designed, that adjacent traffic signals are properly coordinated, that there is adequate supervision of the operation and maintenance of the signal and all of its related devices, and that the traffic signal controller will be selected on the basis of engineering study and judgment.

An investigation of the need for traffic signal control should include where applicable, at least an analysis of the factors contained in the following warrants:

Warrant 1—Minimum vehicular volume.
Warrant 2—Interruption of continuous traffic.
Warrant 3—Minimum pedestrian volume.
Warrant 4—School crossings.
Warrant 5—Progressive movement.
Warrant 6—Accident experience.
Warrant 7—Systems.
Warrant 8—Combination of warrants.
Warrant 9—Four Hour Volumes.
Warrant 10—Peak Hour Delay.
Warrant 11—Peak Hour Volume.

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4C-3 Warrant 1, Minimum Vehicular Volume

The Minimum Vehicular Volume warrant is intended for application where the volume of intersecting traffic is the principal reason for consideration of signal installation. The warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given in the table below exist on the major street and on the higher-volume minor-street approach to the intersection. An "average" day is defined as a weekday representing traffic volumes normally and repeatedly found at the location.

MINIMUM VEHICULAR VOLUMES FOR WARRANT 1

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)	Vehicles per hour on higher-volume minor-street approach (one direction only)
Major Street	Minor Street		
1	1	500	150
2 or more	1	600	150
2 or more	2 or more	600	200
1	2 or more	500	200

These major-street and minor-street volumes are for the same 8 hours. During those 8 hours, the direction of higher volume on the minor street may be on one approach during some hours and on the opposite approach during other hours.

When the 85-percentile speed of major-street traffic exceeds 40 mph in either an urban or a rural area, or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the Minimum Vehicular Volume warrant is 70 percent of the requirements above.

4C-4 Warrant 2, Interruption of Continuous Traffic

The Interruption of Continuous Traffic warrant applies to operating conditions where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or hazard in entering or crossing the major street. The warrant is satisfied when, for each of any 8 hours of an average day, the traffic volumes given in the table below exist on the major street and on the higher-volume minor-street approach to the intersection, and the signal installation will not seriously disrupt progressive traffic flow.

MINIMUM VEHICULAR VOLUMES FOR WARRANT 2

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)	Vehicles per hour on higher-volume minor-street approach (one direction only)
Major Street	Minor Street		
1	1	750	75
2 or more	1	900	75
2 or more	2 or more	900	100
1	2 or more	750	100

These major-street and minor-street volumes are for the same 8 hours. During those 8 hours, the direction of higher volume on the minor street may be on one approach during some hours and on the opposite approach during other hours.

When the 85-percentile speed of major-street traffic exceeds 40 mph in either an urban or a rural area, or when the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the Interruption of Continuous Traffic warrant is 70 percent of the requirements above.

4C-5 Warrant 3, Minimum Pedestrian Volume

The Minimum Pedestrian Volume warrant is satisfied when, for each of any 8 hours of an average day, the following traffic volumes exist:

1. On the major street, 600 or more vehicles per hour enter the intersection (total of both approaches); or where there is a raised median island 4 feet or more in width, 1,000 or more vehicles per hour (total of both approaches) enter the intersection on the major street; and

2. During the same 8 hours as in paragraph (1) there are 150 or more pedestrians per hour on the highest volume crosswalk crossing the major street.

When the 85-percentile speed of major-street traffic exceeds 40 mph in either an urban or a rural area, or when the intersection lies within the built-up area of an isolated community having a population of less than

10,000, the Minimum Pedestrian Volume warrant is 70 percent of the requirements above.

A signal installed under this warrant at an isolated intersection should be of the traffic-actuated type with push buttons for pedestrians crossing the main street. If such a signal is installed at an intersection within a signal system, it should be equipped and operated with control devices which provide proper coordination.

Signals installed according to this warrant shall be equipped with pedestrian indications conforming to requirements set forth in other sections of this Manual.

Signals may be installed at nonintersection locations (mid-block) provided the requirements of this warrant are met, and provided that the related crosswalk is not closer than 150 feet to another established crosswalk. Curbside parking should be prohibited for 100 feet in advance of and 20 feet beyond the crosswalk. Phasing, coordination, and installation must conform to standards set forth in this Manual. Special attention should be given to the signal head placement and the signs and markings used at nonintersection locations to be sure drivers are aware of this special application.

4C-6 Warrant 4, School Crossing

A traffic control signal may be warranted at an established school crossing when a traffic engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of school children at the school crossing shows that the number of adequate gaps in the traffic stream during the period when the children are using the crossing is less than the number of minutes in the same period (sec. 7A-3).

When traffic control signals are installed entirely under this warrant:

1. Pedestrian indications shall be provided at least for each crosswalk established as a school crossing.

2. At an intersection, the signal normally should be traffic-actuated. As a minimum, it should be semi-traffic-actuated, but full actuation with detectors on all approaches may be desirable. Intersection installations that can be fitted into progressive signal systems may have pretimed control.

3. At non-intersection crossings, the signal should be pedestrian-actuated, parking and other obstructions to view should be prohibited for at least 100 feet in advance of and 20 feet beyond the crosswalk, and the installation should include suitable standard signs and pavement markings. Special police supervision and/or enforcement should be provided for a new non-intersection installation.

4C-7 Warrant 5, Progressive Movement

Progressive movement control sometimes necessitates traffic signal installations at intersections where they would not otherwise be warranted, in order to maintain proper grouping of vehicles and effectively regulate group speed. The Progressive Movement warrant is satisfied when:

1. On a one-way street or a street which has predominantly unidirectional traffic, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning and speed control, or

2. On a two-way street, adjacent signals do not provide the necessary degree of platooning and speed control and the proposed and adjacent signals could constitute a progressive signal system.

The installation of a signal according to this warrant should be based on the 85-percentile speed unless an engineering study indicates that another speed is more desirable.

The installation of a signal according to this warrant should not be considered where the resultant signal spacing would be less than 1000 feet.

4C-8 Warrant 6, Accident Experience

The Accident Experience warrant is satisfied when:

1. Adequate trial of less restrictive remedies with satisfactory observance and enforcement has failed to reduce the accident frequency; and

2. Five or more reported accidents, of types susceptible to correction by traffic signal control, have occurred within a 12-month period, each accident involving personal injury or property damage to an apparent extent of $100 or more; and

3. There exists a volume of vehicular and pedestrian traffic not less than 80 percent of the requirements specified either in the Minimum Vehicular Volume warrant, the Interruption of Continuous Traffic warrant, or the Minimum Pedestrian Volume warrant; and

4. The signal installation will not seriously disrupt progressive traffic flow.

Any traffic signal installed solely on the Accident Experience warrant should be semi-traffic-actuated (with control devices which provide proper coordination if installed at an intersection within a coordinated system) and normally should be fully traffic-actuated if installed at an isolated intersection.

4C-9 Warrant 7, Systems Warrant

A traffic signal installation at some intersections may be warranted to encourage concentration and organization of traffic flow networks. The Systems warrant is applicable when the common intersection of two or more major routes has a total existing, or immediately projected, entering volume of at least 800 vehicles during the peak hour of a typical weekday, or each of any five hours of a Saturday and/or Sunday.

A major route as used in the above warrant has one or more of the following characteristics:

1. It is part of the street or highway system that serves as the principal network for through traffic flow;
2. It connects areas of principal traffic generation;
3. It includes rural or suburban highways outside, entering or traversing a city;
4. It has surface street freeway or expressway ramp terminals;
5. It appears as a major route on an official plan such as a major street plan in an urban area traffic and transportation study.

4C-10 Warrant 8, Combination of Warrants

In exceptional cases, signals occasionally may be justified where no single warrant is satisfied but where two or more of Warrants 1, 2, and 3 are satisfied to the extent of 80 percent or more of the stated values.

Adequate trial of other remedial measures which cause less delay and inconvenience to traffic should precede installation of signals under this warrant.

4C-10.1 Warrant 9—Four Hour Volumes

The Four Hour Volume Warrant is satisfied when each of any four hours of an average day the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher volume minor street approach (one direction only) all fall above the curve in Figure 4-7 for the existing combination of approach lanes. IV-43 (c) Rev. 4

When the 85th percentile speed of the major street traffic exceeds 40 miles per hour or when the intersection lies within a built-up area of an isolated community having a population less than 10,000, the four hour volume requirement is satisfied when the plotted points referred to fall above the curve in Figure 4-8 for the existing combination of approach lanes.

4C-10.2 Warrant 10, Peak Hour Delay

The peak hour delay warrant is intended for application where traffic conditions are such that for one hour of the day minor street traffic suffers undue delay in entering or crossing the major street. IV-20 (c) Rev. 4 The peak hour delay warrant is satisfied when the conditions given below exist for one hour (any four consecutive 15-minute periods) of an average weekday.

The peak hour delay warrant is met when:

1. The total delay experienced by the traffic on one minor street approach (one direction only) controlled by a STOP sign equals or exceeds four vehicle-hours for a one-lane approach and five vehicle hours for a two-lane approach, and

2. The volume on the same minor street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes, and

IV-20 (c)
Rev. 4

3. The total entering volume serviced during the hour equals or exceeds 800 vph for intersections with four (or more) approaches or 650 vph for intersections with three approaches.

4C-10.3 Warrant 11, Peak Hour Volume

The peak hour volume warrant is also intended for application when traffic conditions are such that for one hour of the day minor street traffic suffers undue traffic delay in entering or crossing the major street.

IV-20 (c)
Rev. 4

The peak hour volume warrant is satisfied when the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicle per hour of the higher volume minor street approach (one direction only) for one hour (any four consecutive 15-minute periods) of an average day falls above the curve in Figure 4-5 for the existing combination of approach lanes.

When the 85th percentile speed of major street traffic exceeds 40 mph or when the intersection lies within a built-up area of an isolated community having a population less than 10,000, the peak hour volume requirements is satisfied when the plotted point referred to above falls above the curve in Figure 4-6 for the existing combination of approach lanes.

4C-11 Factors Governing Selection of Type of Control

The principal factors that may lead to the favorable consideration of traffic-actuated control in the selection of the type of signal control include:

1. Low, fluctuating or unbalanced traffic volumes.

2. High side street traffic volumes and delays only during the peak hours.

3. The pedestrian or accident warrant is the only warrant which is met.

4. The installation is to provide for one-way movement of two-way traffic.

5. The installation is at a non-intersection location.

4C-12 Pedestrian-Actuated Control

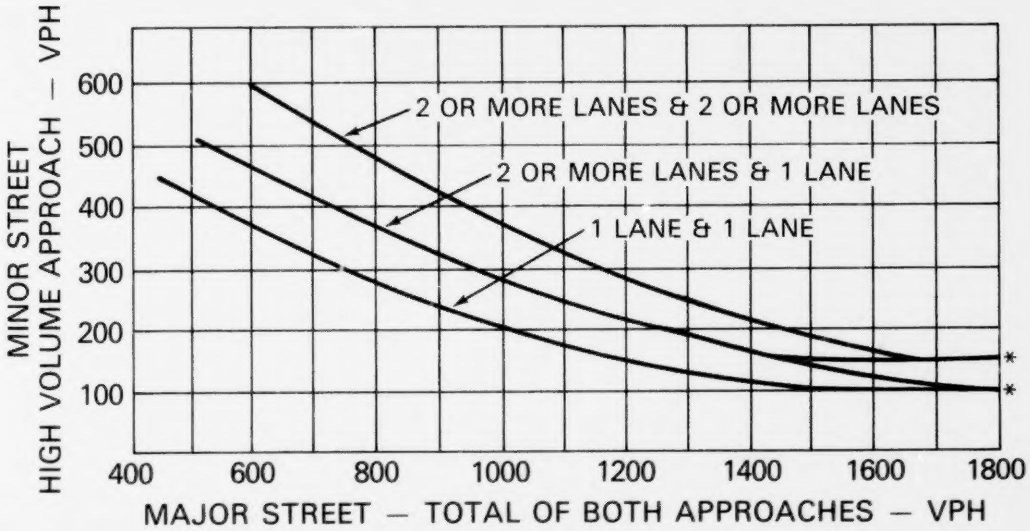
Operation of traffic-actuated signals must take into consideration the needs of pedestrians as well as vehicular traffic. This can be accomplished in the following ways:

1. When pedestrian signals are not warranted (sec. 4D-3) in conjunction with a traffic-actuated signal installation but where occasional pedestrian movement exists and there is inadequate opportunity to cross without undue delay, pedestrian detectors shall be installed and operated as prescribed in sections 4D-6 and 7.

2. When pedestrian signals are not otherwise warranted but a pedestrian movement exists which would not have adequate crossing time during the green interval, pedestrian signals and detectors shall be installed and operated as prescribed in sections 4D-6 and 7.

3. When pedestrian signals are warranted and installed in conjunction with a traffic-actuated signal, the operation should follow the patterns described in sections 4D-6 and 7.

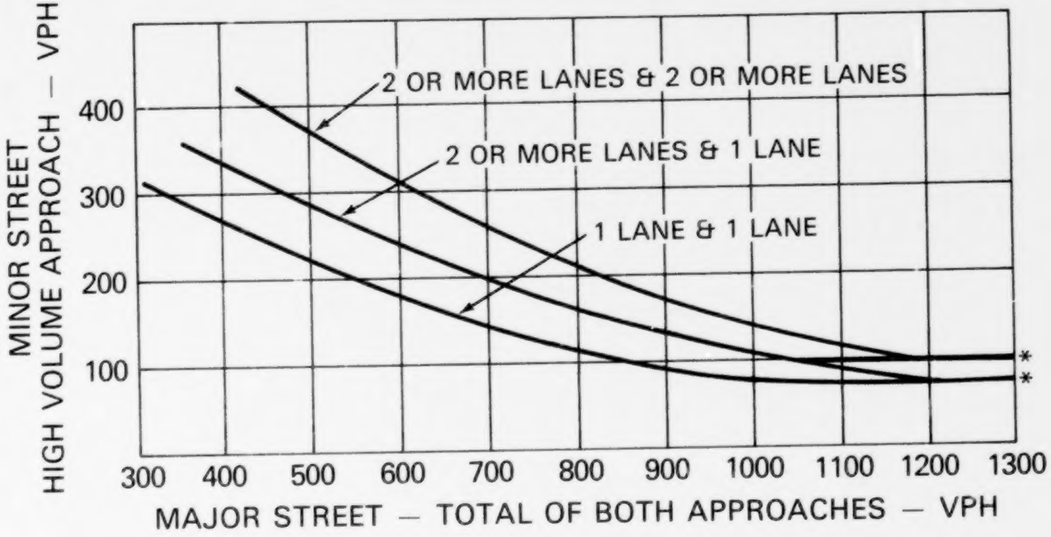
FIGURE 4-5. PEAK HOUR VOLUME WARRANT



*NOTE: 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

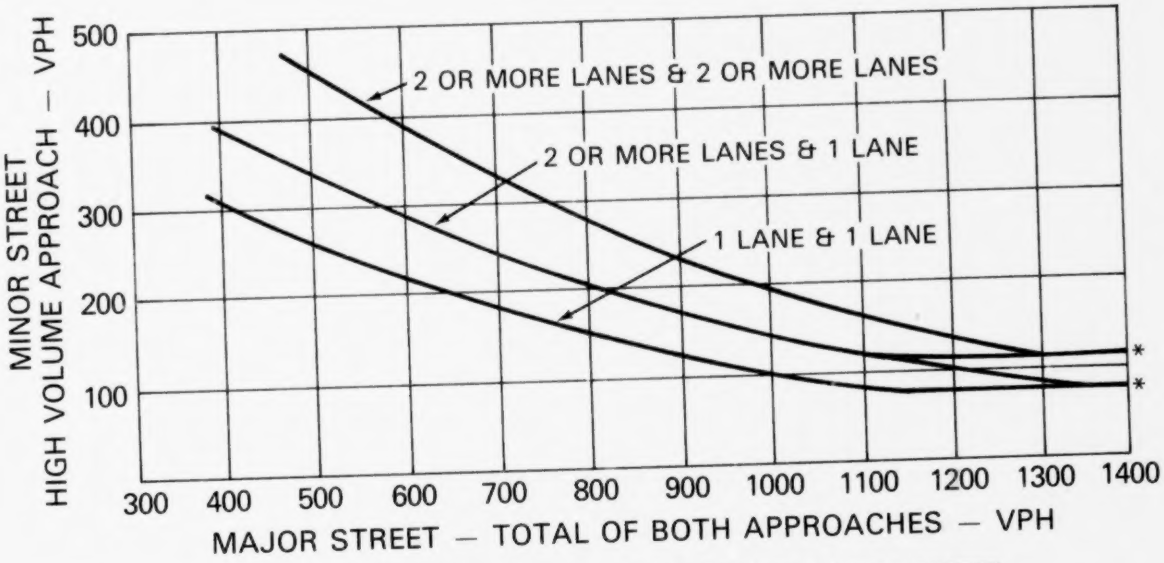
FIGURE 4-6. PEAK HOUR VOLUME WARRANT

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*NOTE: 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 75 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

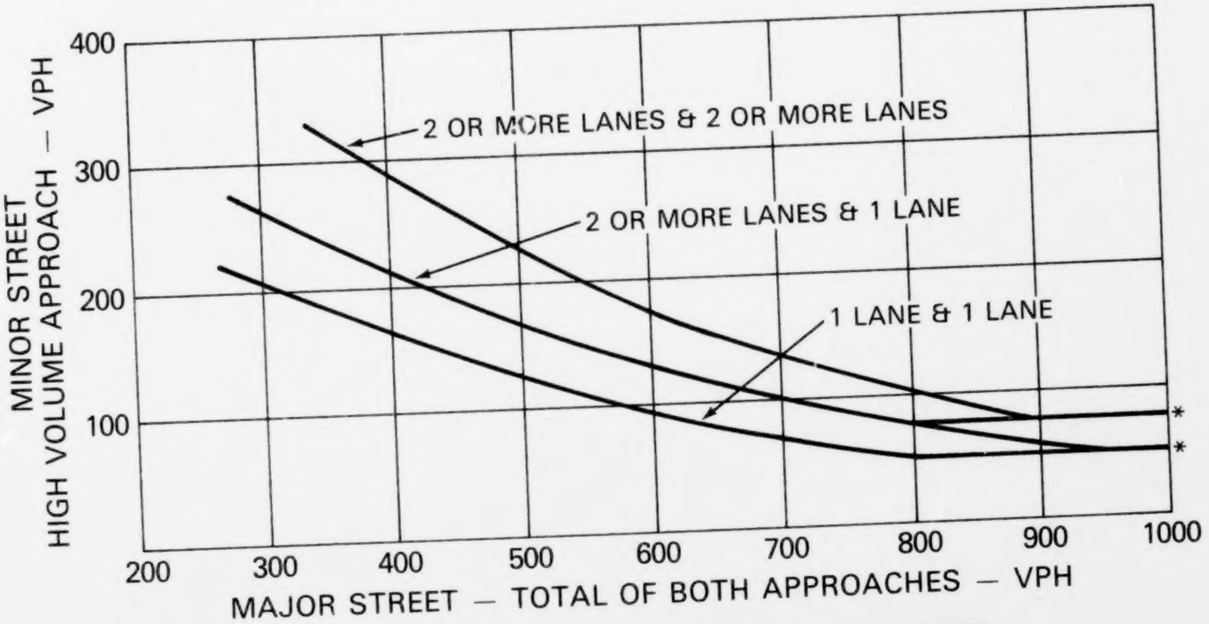
FIGURE 4-7. FOUR HOUR VOLUME WARRANT



*NOTE: 115 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

FIGURE 4-8. FOUR HOUR VOLUME WARRANT

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*NOTE: 80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 60 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

D. PEDESTRIAN SIGNALS

4D-1 Pedestrian Signal Indications

Pedestrian signal indications are special types of traffic signal indications intended for the exclusive purpose of controlling pedestrian traffic. These indications consist of the illuminated words WALK and DONT WALK or the illuminated symbols of a walking person (symbolizing WALK) and an upraised palm (symbolizing DONT WALK).

4D-2 Meaning of Pedestrian Indications

The meanings of pedestrian signal indications are as follows:

1. The DONT WALK indication, steadily illuminated, means that a pedestrian shall not enter the roadway in the direction of the indication.
2. The DONT WALK indication, while flashing, means that a pedestrian shall not start to cross the roadway in the direction of the indication, but that any pedestrian who has partly completed his crossing during the steady WALK indication shall proceed to a sidewalk, or to a safety island.
3. A WALK indication, whether steady or flashing, means that pedestrians facing the signal indication may proceed across the roadway in the direction of the indication. In addition a WALK indication indicates one of the following:
    (a) A steady WALK indication, when used in an area where the optional flashing WALK (see 3b below) is not used, indicates that there may or may not be possible conflicts of pedestrians with vehicles turning on a CIRCULAR GREEN indication.
    (b) A flashing WALK (use optional) indication means that there is a possible conflict of pedestrians with vehicles turning on a CIRCULAR GREEN indication.
    (c) A steady WALK indication when used in an area where the optional flashing WALK is used indicates the absence of conflicts of pedestrians with vehicles turning on a CIRCULAR GREEN indication.

4D-3 Applications of Pedestrian Signal Indications

Pedestrian signal indications shall be installed in conjunction with vehicular traffic signals (which meet one or more of the traffic signal warrants previously set forth) under any of the following conditions:

1. When a traffic signal is installed under the Pedestrian Volume or School Crossing warrant.

2. When an exclusive interval or phase is provided or made available for pedestrian movements in one or more directions, with all conflicting vehicular movements being stopped.

3. When vehicular indications are not visible to pedestrians such as on one-way streets, at "T" intersections; or when the vehicular indications are in a position which would not adequately serve pedestrians.

4. At established school crossings at intersections signalized under any warrant.

Pedestrian signal indications also may be installed under any of the following conditions:

1. When any volume of pedestrian activity requires use of a pedestrian clearance interval to minimize vehicle-pedestrian conflicts or when it is necessary to assist pedestrians in making a safe crossing.

2. When multi-phase indications (as with split-phase timing) would tend to confuse pedestrians guided only by vehicle signal indications.

3. When pedestrians cross part of the street, to or from an island, during a particular interval (where they should not be permitted to cross another part of that street during any part of the same interval).

4D-4 Design Requirements

Design requirements for pedestrian signals include the following:

1. Pedestrian indications should attract the attention of, and be readable to, the pedestrian (both day and night) at all distances from 10 feet to the full width of the area to be crossed.

2. All pedestrian indications shall be rectangular in shape and shall consist of the lettered or symbolized messages WALK and DONT WALK. Only internal illumination shall be used (fig. 4-3). Symbol designs are set forth in the Standard Highway Signs booklet.

3. When illuminated, the WALK indication shall be white conforming to the Pedestrian Traffic Control Signal Indications, *with all except the letters or symbols obscured by an opaque material.

4. When illuminated, the DONT WALK indication shall be Portland orange conforming to the Pedestrian Traffic Control Signal Indications, * with all except the letters or symbols obscured by an opaque material.

5. When not illuminated, the WALK and DONT WALK messages shall not be readily distinguishable by pedestrians at the far end of the crosswalk they control.

6. For crossings where the distance from the near curb to the pedestrian signal indication is 60 feet or less, the letters, if used, shall be at least 3

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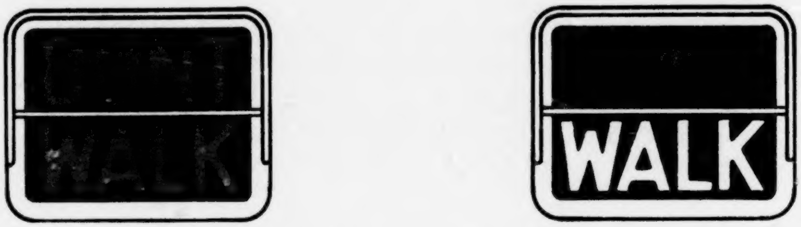
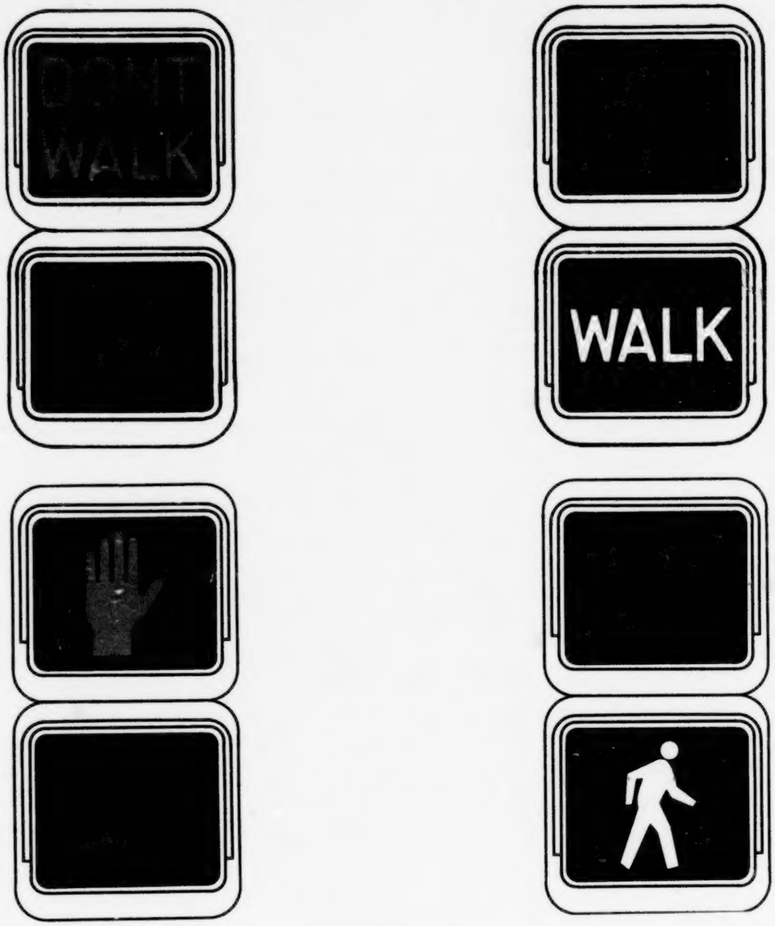
* Available from the Institute of Transportation Engineers, see page iv.


DON'T
WALK
WALK

Single Section with Cut-out Letters


DON'T
WALK
WALK

Two Section Type

Figure 4–3. Pedestrian signal face designs.

inches high or the symbols, if used, shall be at least 6 inches high. For distances over 60 feet, the letters, if used, should be at least 4 ½ inches high and the symbols, if used, should be at least 9 inches high.

7. The light source shall be designed and constructed so that in case of an electrical or mechanical failure of the word DONT, the word WALK of the DONT WALK message will also remain dark.

4D-5 Location

Pedestrian signal faces shall be mounted with the bottom of the housing not less than 7 feet nor more than 10 feet above the sidewalk level, and so there is a pedestrian indication in the line of pedestrians' vision which pertains to the crosswalk being used.

The DONT WALK indication shall be mounted directly above or integral with the WALK indication.

Pedestrian signal heads may be mounted separately or on the same support with other signal heads. When mounted with other signal heads there shall be a physical separation between the two heads.

The pedestrian signal head shall be so positioned and adjusted as to provide maximum visibility at the beginning of the controlled crossing.

4D-6 Detectors

Pedestrian detectors (usually push buttons) should be conveniently located near each end of crosswalks where pedestrian actuation is required. A mounting height of 3 ½ to 4 feet above the sidewalk has been found best adapted to general usage. Permanent-type signs (sec. 2B-37) shall be mounted above or in unit with the detectors, explaining their purpose and use. At certain locations, it may be desirable to supplement this sign with a larger sign suspended over the sidewalk to call attention to the push button. Where two crosswalks, oriented in different directions, end at or near the same location, the positioning of pedestrian push buttons should clearly indicate which crosswalk signal is actuated by each push button. Additional push-button detectors may be required on islands or medians where a pedestrian might become stranded.

Special purpose push-bottons (to be operated only by authorized persons) should include a housing capable of being locked to prevent access by the general public. Instruction signs are not necessary in this case.

A pilot light or other means of indication may be installed with a pedestrian push button and normally shall not be illuminated. Upon actuation, it shall be illuminated until the pedestrian's green or WALK indication is displayed.

4D-7 Pedestrian Intervals and Phases

The four basic combinations of pedestrian signal intervals with vehicular signal operation are as follows:

1. Combined Pedestrian-Vehicular Interval—a signal phasing wherein pedestrians may use certain crosswalks and vehicles are permitted to turn across these crosswalks (the pedestrian indication shall be flashing WALK or steady WALK).

2. Exclusive Crosswalk Interval—a signal phasing wherein pedestrians may use certain crosswalks but vehicles are not permitted to move across these crosswalks during the pedestrian movement (the pedestrian indication shall be steady WALK).

3. Leading Pedestrian Interval—a signal phasing wherein an exclusive pedestrian interval, in advance of the vehicular indication shall be steady WALK. When the leading pedestrian interval is terminated, and a combined pedestrian-vehicular interval begins, the WALK indication may begin to flash.

4. Exclusive Pedestrian Phase—a signal phasing wherein pedestrians may proceed to cross the intersection in any direction during an exclusive phase while all vehicles are stopped (the pedestrian indication shall be steady WALK).

Pedestrians should be assured of sufficient time to cross the roadway at a signalized intersection. Where traffic signals are of the actuated type, control equipment should provide sufficient pedestrian crossing time when there has been a pedestrian actuation and the minimum vehicular time is less than that needed by the pedestrians. Where traffic signals are not of the vehicle-actuated type, pedestrian actuation may be used to provide sufficient pedestrian crossing time, or the vehicular time should be adjusted to provide the crossing time needed by pedestrians.

Under normal conditions, the WALK interval should be at least 4 to 7 seconds in length so that pedestrians will have adequate opportunity to leave the curb before the clearance interval is shown. The lower values may be appropriate where it is desired to favor the length of an opposing phase and if pedestrian volumes and characteristics do not require the longer interval, the WALK interval itself need not equal or exceed the total crossing time calculated for the street width, as many pedestrians will complete their crossing during the flashing DONT WALK clearance interval.

A pedestrian clearance interval shall always be provided where pedestrian signal indications are used. It shall consist of a flashing DONT WALK indication. The duration should be sufficient to allow a pedestrian crossing in the crosswalk to leave the curb and travel to the center of the farthest traveled lane before opposing vehicles receive a green indication (normal walking speed is assumed to be 4 feet per second). On a street with a median at least 6 feet in width, it may be desirable to allow only enough pedestrian clearance time on a given phase to clear the crossing from the curb to the median. In the latter case, if the signals are pedestrian actuated, an additional detector shall be provided on the island (sec. 4D-6).

At intersections equipped with pedestrian signals, the pedestrian signals shall be displayed except when the traffic signal is being operated as a flashing device. At those times, the pedestrian indications shall not be illuminated.

E. OTHER HIGHWAY TRAFFIC SIGNALS

4E-1 Hazard Identification Beacon

A Hazard Identification Beacon is one or more sections of a standard traffic signal head with a flashing CIRCULAR YELLOW indication in each section. Typical applications include:

1. Obstructions in or immediately adjacent to the roadway.
2. Supplemental to advance warning signs.
3. At mid-block crosswalks.
4. At intersections where warning is required.
5. Supplemental to regulatory signs, except the STOP, YIELD and DO NOT ENTER signs.

A Hazard Identification Beacon shall be used only to supplement an appropriate warning or regulatory sign or marker. The beacon shall not be included within the border of the sign except for School Speed Limit signs (secs. 4E-2 and 7B-12).

Hazard Identification Beacons, when used at intersections, shall not face conflicting vehicular approaches.

4E-2 Speed Limit Sign Beacon

A Speed Limit Sign Beacon is two CIRCULAR YELLOW lens sections each having a visible diameter of not less than 6 inches, or as an alternate, one or more CIRCULAR YELLOW lenses, each having a visible diameter of not less than 8 inches. Where two lenses are used, they shall be vertically aligned, except that they may be horizontally aligned if the speed sign is longer horizontally than vertically, and they shall be alternately flashed.

A Speed Limit Sign Beacon is intended for use with a fixed or variable speed limit sign. Where applicable, a flashing speed limit beacon (with an appropriate accompanying sign) may be used to indicate that the speed limit shown is in effect. The lenses of a Speed Limit Beacon when used with a School Speed Limit sign may be positioned within the face of the sign.

4E-3 Intersection Control Beacon

An Intersection Control Beacon consists of one or more sections of a standard traffic signal head, having flashing CIRCULAR YELLOW or CIRCULAR RED indications in each face. They are installed and are used only at an intersection to control two or more directions of travel. Supplemental indications may be needed on one or more approaches in order to provide adequate visibility to approaching motorists.

Intersection Control Beacons are intended for use at intersections where traffic or physical conditions do not justify conventional traffic signals but where high accident rates indicate a special hazard.

Application of Intersection Control Beacons shall be limited to:

1. Yellow on one route (normally the major roadway) and red for the remaining approaches.

2. Red for all approaches (where all-way stop is warranted).

A stop sign should be used with a flashing red Intersection Control Beacon (fig. 4–4).

Flashing yellow indications shall not face conflicting vehicular approaches.

4E–4 Stop Sign Beacon

A Stop Sign Beacon is one or more sections of a standard traffic signal head with a flashing CIRCULAR RED indication in each section. Where a single lens is used, it may be either 8 or 12 inches nominal diameter. Where two lenses are used, they shall be not less than 8 inches nominal diameter; if aligned horizontally they shall be flashed simultaneously, and if aligned vertically, they shall be flashed alternately.

The bottom of the housing of a Stop Sign Beacon shall be not less than 12 nor more than 24 inches above the top of a stop sign (sec. 2B–4).

4E–5 General Design and Operation of Beacons

Flashing beacon units and their mounting shall follow the general design specifications for traffic control signals, which shall include the following essentials:

1. Each signal unit lens shall have a visible diameter of not less than 8 inches, except for Speed Limit Sign Beacons described in section 4E–2.

2. When illuminated, the beacon shall be clearly visible (to all drivers it faces) for a distance of at least ¼ mile under normal atmospheric conditions, unless otherwise physically obstructed.

3. The red and yellow lens colors shall be in accordance with the Vehicle Traffic Control Signal Head Equipment Standard. *

All flashing contacts should be equipped with filters for suppression of radio interference.

Beacons shall be flashed at a rate of not less than 50 nor more than 60 times per minute. The illuminated period of each flash shall not be less than one-half and not more than two-thirds of the total cycle. When Hazard Identification Beacons have more than one section, they may be flashed alternately.

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* Available from the Institute of Transportation Engineers, see page iv.

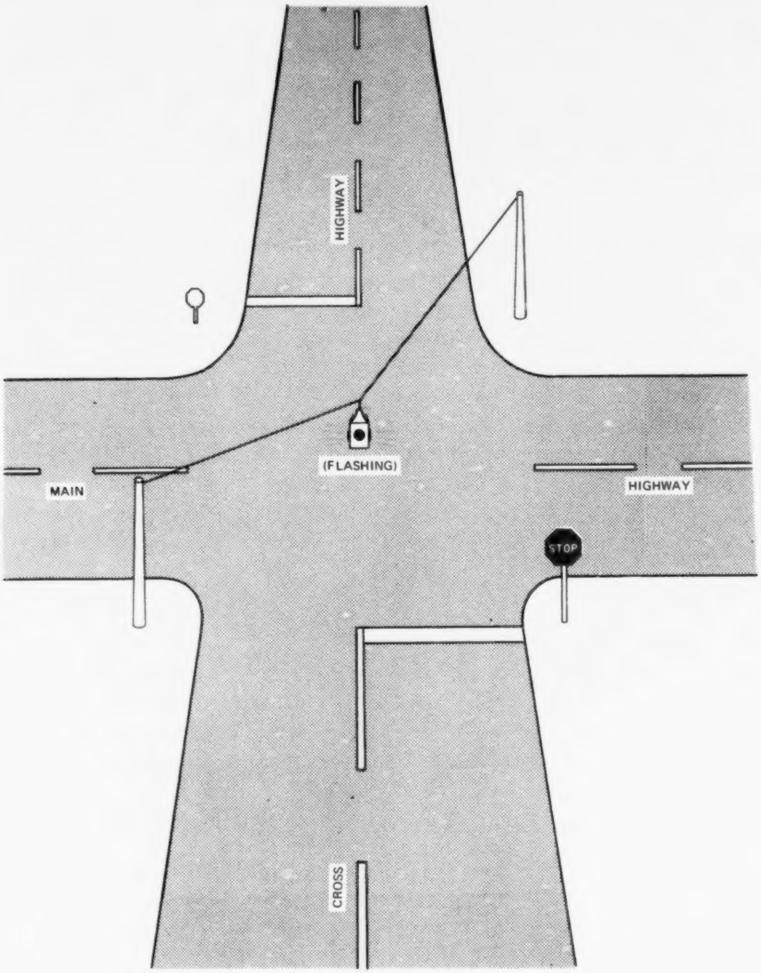

Figure 4-4. Typical intersection control beacon installation.

Hazard Identification Beacons should be operated only during those hours when the hazard or regulation exists.

A flashing yellow beacon interconnected with a traffic signal controller may be used with an advance traffic signal warning sign (sec. 2C-17).

If a 150 watt lamp is used in a 12-inch lens flashing yellow beacon and the flashing yellow is so bright as to cause excessive glare during night operation, an automatic dimming device should be used to reduce the brilliance during night operation.

If used to supplement a warning or regulatory sign, individual flashing beacon units should be horizontally or vertically aligned. The edge of housing should normally be located no closer than 12 inches outside of the nearest edge of the sign (not applicable to School Speed Limit Beacons located within the sign—secs. 4E-2 and 7B-12).

4E-6 Hazard Identification Beacon Location

The hazard or other condition warranting Hazard Identification Beacons should largely govern their location with respect to the roadway. If used alone and located at the roadside, the bottom of the beacon unit shall be at least 8 feet and not more than 12 feet above the pavement. If suspended over the roadway, the clearance above the pavement shall not be more than 19 feet nor less than 15 feet. In no case should they be mounted on pedestals in the roadway unless the pedestal is within the confines of a traffic or pedestrian island. Where an obstruction is in or adjacent to the roadway, illumination of the lower portion or the beginning of the obstruction, or a sign on or in front of the obstruction is desirable, in addition to the beacon.

4E-7 Intersection Control Beacon Location

An Intersection Control Beacon is generally suspended over the center of an intersection; however, it may be used at other suitable locations. If suspended over the roadway the clearance above the pavement shall be at least 15 feet but not more than 19 feet. If pedestal mounting is used, the bottom of the signal head shall be at least 8 feet but not more than 15 feet above the pavement. In no case should it be mounted on a pedestal in the roadway unless the pedestal is within the confines of a traffic or pedestrian island.

4E-8 Lane-use Control Signals

Lane-use control signals are special overhead signals having indications used to permit or prohibit the use of specific lanes of a street or highway or to indicate the impending prohibitions of use. Installations are distinguished by placement of these special signals over a certain lane or lanes of the roadway and by their distinctive shapes and symbols. Supplementary signs are often used to explain their meaning and intent.

Lane-use control signals are most commonly used for reversible-lane control. This type of control should be used only when a competent engineering study shows that there is need and also that the planned operation is practicable. Reversible-lane operation may be appropriate at toll-booth areas.

Lane-use control also may be used where there is no intent or need to reverse lanes. Some applications of this type are:

1. On a freeway, where it is desired to keep traffic out of certain lanes at certain hours to facilitate the merging of traffic from a ramp or other freeway.

2. On a freeway, near its terminus, to indicate a lane that ends.

3. On a freeway or long bridge, to indicate a lane which may be temporarily blocked by an accident, breakdown, etc.

4E-9 Meaning of Lane-use Control Signal Indications

The meanings of lane-use control signals are as follows:

1. A steady DOWNWARD GREEN ARROW means that a driver is permitted to drive in the lane over which the arrow signal is located.

2. A steady YELLOW X means that a driver should prepare to vacate, in a safe manner, the lane over which the signal is located because a lane control change is being made, and to avoid occupying that lane when a steady RED X is displayed.

3. A flashing YELLOW X means that a driver is permitted to use a lane over which the signal is located for a left turn. The driver is cautioned that he may be sharing that lane with opposite flow left-turning vehicles.

4. A steady RED X means that a driver shall not drive in the lane over which the signal is located, and that this indication shall modify accordingly the meaning of all other traffic controls present. The driver shall obey all other traffic controls and follow normal safe driving practices.

4E-10 Design of Lane-use Control Signals

All lane-use control signal indications shall be in units with rectangular faces. Nominal minimum height and width of each face shall be 12 inches for typical applications. However, other sizes with message recognition distances appropriate to signal spacing may be employed for unusual applications.

Each lane to be reversed shall have signal faces with a DOWNWARD GREEN ARROW on an opaque background, and a RED X symbol on an opaque background. Signal faces with a YELLOW X symbol on an opaque background may be provided for operation as described in section 4E-12.

Each nonreversible lane immediately adjacent to a reversible lane shall have signal indications which display a DOWNWARD GREEN ARROW to traffic traveling in the permitted direction and a RED X to traffic traveling in the opposite direction. Other nonreversible lanes on any street so controlled may also be provided with these indications.

The indications provided for each lane may be in separate units or may be superimposed in the same unit. When in separate units, the RED X symbol shall be on the left, the YELLOW X symbol, if used, shall be in the middle and the DOWNWARD GREEN ARROW symbol shall be on the right.

The color of lane-use control signal indications shall be clearly visible for ¼ mile at all times under normal atmospheric conditions, unless otherwise physically obstructed.

The visibility angle of the lane-use control signal shall be at least as great as that specified for the standard circular traffic signal (sec. 4B-11).

4E-11 Location of Lane-use Control Signals

Lane-use control signal units shall be located approximately over the center of the lane controlled.

If the area to be controlled is more than ¼ mile in length, or if the vertical or horizontal alignment is curved, intermediate lane-use control signal indications shall be placed over each controlled lane at frequent intervals. This placement shall be such that a motorist will at all times be able to see at least one indication, and preferably two (due to the possibility of a burnout of a single indication) along the roadway, and will have a definite indication of the lanes specifically reserved for his use.

All lane-use control indications shall be located in a straight line across the roadway at right angles to the roadway alignment.

The bottom of any lane-use control signal unit shall be not less than 15 feet nor more than 19 feet above the pavement grade.

On roadways having intersections controlled by traffic signals, the lane-use control indication shall be placed sufficiently far in advance of or beyond such traffic signals to prevent them from being misconstrued as traffic control signals. Twelve-inch lenses may be necessary in the intersection traffic control signals to aid in distinguishing between the two types of signals.

4E-12 Operation of Lane-use Control Signals

All reversible-lane control signals shall be coordinated and wired to a master control which will operate so as to permit signal indications for each direction in any of the reversing lanes to change from a steady RED X to a DOWNWARD GREEN ARROW or from a DOWNWARD GREEN ARROW to a steady YELLOW X when used, and then to a steady RED X. The showing of a DOWNWARD GREEN ARROW or steady YELLOW X or any combination thereof, in both directions over the same lane, shall be guarded against by electrical interlock.

During change-over periods, a steady YELLOW X indication may be used to notify traffic in a reversible lane to prepare to vacate the lane.

Alternatively the steady RED X may immediately follow the termination of the steady DOWNWARD GREEN ARROW, and in this case a clearance period of appropriate length shall be provided, during which the steady RED X shall be shown in both directions over the lane before the steady DOWNWARD GREEN ARROW indication is shown for traffic from the opposite direction.

Where feasible, a flashing YELLOW X for both directions may be used over a lane to permit use of that lane for left turns, with due caution.

The type of control provided for reversible-lane operation should be such as to permit either automatic or manual operation of the lane-use control signals. If an automatic system is used, a manual control to override the automatic control shall be provided.

When used, lane-use signals shall be operated continuously.

4E-13 Traffic Control at Movable Bridges

Traffic control at movable bridges shall include both signals and warning gates except:

1. Neither is required when other traffic control devices or measures are used which are considered appropriate for conditions at the site: (a) on low volume roads (roads of less than 400 average daily traffic), or (b) at manually operated bridges where electric power is not available.
2. Only signals are required in urban areas when intersecting streets or driveways make gates ineffective.
3. Only warning gates are required where a stop and go traffic control signal which is controlled as part of the bridge operations exists within 500 feet of the warning gates and no intervening traffic entrances exist.

Resistance gates are often required at movable bridges to provide a physical barrier for moving vehicles. Resistance gates are considered a design feature not a traffic control device and requirements for them are contained in the Standard Specifications for Movable Highway Bridges. * However, the location of the movable bridge signals and gates will be determined from the location of the resistance gates (where used) rather than by the location of the movable spans. Resistance gates for high speed highways are preferably located 50 ft. or more from the span opening except for bascule and lift bridges where they are often attached to, or are a part of, the structure.

4E-14 Movable Bridge Signals and Gates

Signals installed at movable bridges are a special type of highway traffic signal, the purpose of which is to notify traffic to stop because of the road closure rather than alternately giving the right-of-way to conflicting traffic

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* Available from the American Association of State Highway and Transportation Officials, 444 N. Capitol St., NW., Suite 225, Washington, D.C. 20001.

movements. They are operated in coordination with the opening and closing of the movable bridges, and with the operation of resistance and warning gates, barriers, or other devices and features used to warn, control and stop vehicles. Unlike traffic control signals, movable bridge signals may be operated frequently or at extremely infrequent intervals depending upon waterway traffic.

Warning gates installed at movable bridges are for the purpose of decreasing the likelihood of vehicles and pedestrians passing the stop line and entering an area where hazards exist because of the operation of the bridge.

4E-15 Design of Movable Bridge Signals and Gates

The signal heads and mountings of movable bridge signals shall follow the standard design specifications for traffic control signals.

Nominal 8-inch signal indications are standard. However, if prevailing approach speeds are in excess of 25 mph, or when considerations such as roadway width or geometrics, signal location, conflicting lights or objects in the background, etc., indicate the need for greater signal effectiveness, signal heads with 12-inch diameter lenses should be provided.

Movable bridge signals may be supplemented with bells to provide additional warning to drivers and pedestrians.

Since movable bridge operation covers so wide a range of time periods between openings, two types of signals are provided. The first type consists of the standard three color (red, yellow, and green) traffic signal indications, generally to be used when movable bridge operation is quite frequent. The second type consists of two red signal indications in vertical array separated by a STOP HERE ON RED sign (sec. 2B-37).

Where physical conditions prevent a driver (traveling at the 85 percentile approach speed) from having a continuous view of at least one signal indication for approximately 10 seconds before reaching the stop line, an auxiliary device shall be provided in advance of movable bridge signals and gates. This device may be either a supplemental signal or the mandatory DRAWBRIDGE AHEAD sign to which has been added a Hazard Identification Beacon interconnected with the movable bridge controller.

A DRAWBRIDGE AHEAD warning sign shall be used in advance of movable bridge signals and gates to give advance warning to motorists, except in urban conditions where such signing would not be practicable. Such signs may be supplemented by a Hazard Identification Beacon (sec. 4E-1). The beacon is not required except as noted in the above paragraph.

Warning gates shall be at least standard RR size striped with 16-inch alternate diagonal, fully reflectorized red and white stripes. They shall preferably be of light weight construction. Flashing red lights may be included on the gate arm where all traffic is to be stopped but shall only be operated when the gate is closed or in the process of being opened or closed. In its normal upright position the gate arm should be either vertical or nearly so and provide adequate lateral clearance. In the horizontal position the top of the gate shall be approximately 4 feet above the pavement. If the movable bridge is close to a railroad grade crossing and there is a possibility that traffic may be stopped on the crossing as a result of the bridge opening, a traffic control device should be provided to give notification to the driver not to stop on the railroad tracks. Extreme care should be used in planning such installations to avoid creating confusion or hazardous conditions.

Signals on adjacent streets and highways should be interconnected with the drawbridge control, if indicated by engineering considerations.

4E-16 Location of Movable Bridge Signals and Gates

Two signal indications shall be provided for each approach to the movable span regardless of which signal type is selected.

Insofar as practicable, the height and lateral placement of signals should conform to the requirements for other traffic control signals in accordance with sec. 4B-12. They should be located not more than 50 feet in advance of the warning gate or other barrier except as otherwise noted.

Warning gates, where used, shall extend at least across the full width of the approach lanes where resistance gates are used. If resistance gates are not used on undivided highways, warning gates, if used, should extend across the full width of the roadway. On divided highways in which the roadways are separated by a barrier median, warning gates, if used, shall extend across all roadway lanes approaching the span openings. A single full width gate or two half-width gates may be used. Except as indicated below, wherever practical, warning gates shall be located 100 feet or more from the resistance gates or, when no resistance gates are used, 100 feet or more from the movable span.

On bridges or causeways that cross a long reach of water and which may be impacted by large marine vessels, it may be desirable, within the limitations of practicability, to halt traffic on a section of the bridge or causeway that is not subject to impact. In some cases, such as long causeways, it may not be practical to halt traffic on a span which is completely safe from impact. In such cases the traffic should be halted at least one span from the opening. Where traffic is halted by signals and gates more than 330 feet from the resistance gates or from the span opening when no resistance gates are used, a second set of gates should be installed approximately 100 feet from the resistance gate or span opening. Traffic signals need not accompany the gates nearest the span opening but there shall be flashing red lights on the warning gate.

4E-17 Operation of Movable Bridge Signals and Gates

Traffic control devices at movable bridges shall be coordinated with the movable span, so that signals, gates and movable span are controlled by the bridge tender through an interlocked control.

Where the three-color type of signal is used, the green signal indication shall be illuminated at all times between bridge opening periods, except that when the bridge is not expected to be open for continuous periods in excess of 5 hours a flashing yellow indication may be used. The signal shall display continuous red when traffic is required to stop.

The yellow interval between the display of green and red shall be predetermined and shall be displayed normally approximately 3 to 6 seconds.

When the vertical array of red signals is selected, it shall be operated with alternate flash and shall operate only during periods when traffic is required to stop.

4E-18 Traffic Signals for Emergency Vehicle Movements

An emergency-traffic signal is a special adaptation of a traffic control signal to obtain the right-of-way for an authorized emergency vehicle. An emergency-traffic signal may be installed at a location that does not meet the warrants prescribed for the various types of other traffic signal installations. It may be installed at an intersection or at other locations where there is direct access from a building housing the emergency vehicle.

Right-of-way for emergency vehicles at signalized locations shall be obtained as specified in section 4B-22.

4E-19 Applications of Emergency-Traffic Signals

At an unsignalized location, an emergency-traffic signal may be justified if adequate gaps in traffic do not exist to permit safe entrance of emergency vehicles, or the stopping sight distance for vehicles approaching on the through street is insufficient to permit safe entrance of emergency vehicles.

The sight distance determination is based on the location of the visibility obstruction for the critical approach lane for each street or drive, and the posted or 85th percentile speed on the through street, whichever is higher.

If warrants for a traffic control signal (sec. 4C) are met, a signal normally should be installed to the standards required for that type of signal (sec. 4B).

The use of emergency-traffic signals to permit direct access to a street from a building housing emergency equipment is optional.

4E-20 Design of Emergency-Traffic Signals

Except as specified in this section, a traffic control signal for emergency vehicle movements shall meet the requirements of this Manual.

At least one signal face should be located over the roadway.

A sign, legible at all times, bearing the legend EMERGENCY SIGNAL should be mounted adjacent to each signal face.

A Hazard Identification Beacon may be installed in advance of an emergency-traffic signal. Such beacon shall be accompanied by an appropriate warning sign. The design and location of the beacon shall conform to the standards specified in sections 4E-1 and 4E-5.

A minimum of one signal face shall face the direction of approach of the emergency vehicle.

4E-21 Operation of Emergency-Traffic Signals

As a minimum, the indications, sequence and manner of operation of an emergency traffic control signal installed at a mid-block location shall be as follows:

1. The signal indication, between emergency vehicle actuations, shall be either a steady green or flashing yellow. When used in lieu of the steady green, the flashing yellow shall be displayed in the normal position of the steady green while the red and steady yellow will be displayed in their normal positions.

2. There shall always be a steady yellow change indication shown to traffic on the street, but a change indication is not required for the emergency vehicle driveway.

3. There shall be a steady red signal indication for traffic on the street. The duration of the red period should be determined on the basis of on-site test run-time studies, but should normally not exceed 1.5 times the emergency vehicle passage or clearance time.

4. It has been found advantageous to use the following size lenses: 12-inch diameter for red and steady yellow indications, and 8-inch diameter for flashing yellow indications and steady green indications. Other appropriate means to reduce the flashing yellow light output may be used.

An intersectional or mid-block emergency-traffic signal may be actuated manually from a local control point such as a fire station, police headquarters or civil defense office, or from an emergency vehicle equipped for remote operation of the signal.

Hazard Identification Beacons, used with an emergency-traffic signal, shall be actuated from a nonilluminated condition at the same time as the emergency-traffic signal is changed to steady yellow.

Emergency-traffic signals located at intersections should be operated either in the flashing mode between emergency actuations (sec. 4B-18) or should be semi- or fully traffic-actuated, to accommodate normal vehicular and pedestrian traffic on the streets.

4E-22 Traffic Signals at Freeway Entrance Ramps

Traffic control signals may be installed on freeway entrance ramps to control the flow of traffic entering the freeway facility. Except as noted herein, these ramp control signals shall meet all of the standard design specifications for traffic control signals.

1. The standard display for freeway entrance ramp control signals shall be either a two-indication signal face containing red and green lenses or a standard three-indication signal face containing red, yellow, and green lenses.
2. There shall be a minimum of two signal faces per ramp facing entering traffic.
3. On entrance ramps having more than one lane there shall be a signal face mounted on the left side and on the right side.
4. The required signal faces should be mounted such that the height to the bottom of the housing of the lowest signal face is between 4 ½ and 6 feet. The height of any supplemental signal faces should be consistent with sound design principles and engineering judgment within the limitations provided in section 4B-13.
5. All ramp control signals shall utilize vertically aligned lenses with a minimum nominal diameter of 8 inches.
6. Ramp control signals need not be illuminated when not in use.

4E-23 Guidelines for Freeway Entrance Ramp Control Signals

There are too many variables that influence freeway capacity (number of lanes, trucks, gradients, merging, weather, etc.) to permit developing numerical volume warrants that are applicable to the wide variety of conditions found in practice. However, general guidelines have been identified for successful application of ramp control.

The installation of ramp control signals should be preceded by an engineering analysis of the physical and traffic conditions on the highway facilities likely to be affected. The study should include the ramps and ramp connections and the surface streets which would be affected by the ramp control, as well as the freeway section concerned. Types of traffic data which should be obtained include, but are not limited to traffic volumes, traffic accidents, freeway operating speeds, travel time and delay on the freeway and on alternate surface routes.

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Capacities and demand/capacity relationships should be determined for each freeway section. The locations and causes of capacity restrictions and those sections where demand exceeds capacity should be identified. From these and other data, estimates can be made of desirable metering rates, probable reductions in delay of freeway traffic, likely increases in delay to traffic on ramps, and the potential impact on surface streets. The analysis should include an evaluation of storage capacities on the ramp for vehicles delayed at the signal, the impact of quened traffic on the local street intersection, and the availability of suitable alternate surface routes having adequate capacity to accommodate any additional traffic volume.

Before installing ramp control signals, consideration should be given to public acceptance potential and enforcement requirements of ramp control, as well as alternate means of increasing the capacity, reducing the demand, or improving characteristics of the freeway.

Installation of freeway entrance ramp control signals may be justified when the total expected delay to traffic in the freeway corridor, including freeway ramps and local streets, is expected to be reduced with ramp control signals and when at least one of the following instances occurs:

1. There is recurring congestion on the freeway due to traffic demand in excess of the capacity; or there is recurring congestion or a severe accident hazard at the freeway entrance because of inadequate ramp merging area. A good measure of recurring freeway congestion is freeway operating speed. An early indication of a developing congestion pattern would be freeway operating speeds less than 50 mph, occurring regularly for a period of half an hour. Freeway operating speeds less than 30 mph for a half-hour period would be an indication of severe congestion. IV-29 (c) Rev. 3
2. The signals are needed to accomplish transportation system management objectives identified locally for freeway traffic flow, such as:

   (a) maintenance of a specific freeway level of service, or (b) priority treatments with higher levels of service, for mass transit and carpools.
3. The signals are needed to reduce (predictable) sporadic congestion on isolated sections of freeway caused by short-period peak traffic loads from special events of from severe peak loads of recreational traffic.

4E-24 Traffic Signals for One-Lane, Two-Way Facilities

A traffic signal for control of traffic at a narrow bridge or tunnel is a special adaptation of a signal to assign right-of-way for vehicles passing over a bridge or through a tunnel which is not sufficient in width for two opposing vehicles to meet and pass safely. A narrow bridge or tunnel signal may be installed at locations that do not meet the warrants prescribed for the various types of other traffic signal installations.

4E-25 Applications of One-Lane Bridge or Tunnel Signals

At an unsignalized location, a signal may be justified if gaps in opposing traffic do not permit safe operation of traffic flow through the one-lane section of roadway. Sight distance across or through the structure must also be considered as well as the approach speed and sight distance approaching the bridge or tunnel.

4E-26 Design of Bridge and Tunnel Signals

The signal heads and mounting of the narrow bridge or tunnel signal shall follow the standard design specifications for traffic control signals.

Nominal 8-inch signal indications are standard; however, if prevailing approach speeds are in excess of 40 mph or when considerations, such as roadway width or geometrics, signal locations with conflicting lights or objects in the background, etc., indicate the need for greater signal effectiveness, signal heads with 12-inch diameter lenses and 100 watt or larger lamps should be provided.

Visibility for each approach signal shall be provided and should be continuously visible from a point at least the following distances in advance of and to the stop line, unless physical obstruction of their visibility exists:

Table 4-1

85 Percentile Speed (mph)	*Minimum Visibility Distance (ft.)*
20	175
25	215
30	270
35	325
40	390
45	460
50	540
55	625
60	715

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Where physical conditions prevent drivers from having a continuous view of at least two signal indications as specified herein, a suitable sign shall be erected to warn approaching traffic. It may be supplemented by a Hazard Identification Beacon (sec. 4E-1). A beacon utilized in this manner may be interconnected with the traffic signal controller in such a manner as to flash yellow during the period when drivers passing this beacon, at the legal speed for the roadway, may encounter a red signal upon arrival at the signalized location.

4E-27 Location of Narrow Bridge or Tunnel Signals

Two signal indications shall be provided for each approach to the bridge or tunnel. One signal shall be at the left or over the left half of the roadway and the other at the right or over the right half of the roadway.

Insofar as is practical, the height and lateral placement of the signal should conform to the requirements for other traffic control signals. The signal should ordinarily be from 40 to 120 feet beyond the stop bar position.

4E-28 Operation of Narrow Bridge or Tunnel Signals

Signals at narrow bridges or tunnels shall operate in a manner consistent with traffic requirements, except that an adequate clearance must be provided to allow the structure to clear before the opposing traffic is allowed to move.

Data from engineering studies shall be used to determine the proper timing for the signal.

Since traffic flows and patterns change, it is necessary that the engineering data be updated and reevaluated regularly.

To assure that the approved operation timing is correct, regular checks, including the use of accurate timing devices, should be made.

When required for flashing operations, the signals shall be flashed red.

Part V. ISLANDS

A. GENERAL

5A-1 Scope of Island Standards

A traffic-control island is a defined area between traffic lanes for control of vehicle movements or for pedestrian refuge. Within an intersection area, a median or an outer separation is considered to be an island. An island may be designated by paint, raised bars, mushroom buttons, curbs, guideposts, pavement edge, or other devices.

For the purposes of this Manual, an island includes not only the designated area but also all end protection and approach end treatments.

It should be realized that islands constitute an integral part of the geometric design of streets and highways and should be included in overall projects for construction. At times, however, an island may need to be installed at an existing intersection to improve or correct an outdated design. This Manual treats primarily the traffic-control characteristics of islands rather than their design features; however, certain minimum standards are given. Other features of island design are presented to be used as guidelines.

5A-2 Legal Authority

All traffic islands shall be installed by the authority of the public body or official having jurisdiction. For those islands that are elements of street and highway design and are included in the design of the street or highway, no specific authority is required.

5A-3 Classification and Function

Islands frequently serve more than one purpose but may be generally classified according to their main function as follows:

1. Pedestrian refuge islands.
2. Traffic divisional islands.
3. Traffic channelizing islands.

5A-4 Pedestrian Refuge Islands

The specific function of a refuge island is to provide a place of safety for pedestrians who cannot cross the entire roadway width at one time in safety because of changing traffic signals or on-coming traffic.

Refuge islands are particularly useful at intersections in urban areas where there is a considerable amount of pedestrian traffic and where heavy volumes of vehicular traffic make it difficult and dangerous for pedestrians to cross, such as:

1. On multi-lane roadways.
2. In large or irregularly shaped intersections.
3. At signalized intersections to provide a place of safety between different traffic streams.

When refuge islands are required at each intersection along a street, consideration should be given to providing a continuous median divider strip between intersections.

Passenger loading islands are considered to be a special class of refuge islands inasmuch as they serve as a pedestrian refuge while loading and unloading passengers from transit vehicles.

5A-5 Traffic Divisional Islands

The function of divisional islands is to separate opposing traffic; also, they may be used to separate traffic in the same direction, e.g., to divide left-turn traffic in a median lane from the through traffic. Divisional islands are used to guide traffic around an obstruction within the roadway (such as a bridge pier), in advance of an intersection to separate opposing traffic and may be located to prevent overtaking and passing at hazardous points, such as sharp curves or narrow underpasses.

Where divisional islands are continuous, they are called medians; the more important functions are as follows:

1. Medians provide an insulating area between opposing streams of moving traffic.
2. Medians provide protection and control of cross and turning traffic.
3. Medians provide a refuge for pedestrians.

5A-6 Traffic Channelizing Islands

The primary function of a channelizing island is to control and direct a vehicle operator into the proper channel for his intended route. Channelizing islands may be installed in areas that otherwise would be broad expanses of pavement, to bring about an orderly flow of traffic.

Channelization is particularly helpful at streets intersecting at oblique angles, at 3-leg junctions, and at multileg intersections.

Traffic channelizing islands may be provided for separation (and special control) of turning movements.

B. DESIGN

5B-1 General

The necessity for islands should be determined only by careful study, since they are placed in an area that would otherwise be available for vehicular traffic. This is particularly true for a channelizing island because the shape and size of the island will vary widely according to the intersection conditions. For this reason, it may be desirable to test the layout by temporarily delineating channelizing islands before final installation.

Islands should be carefully planned and designed to provide travel paths that are obvious, easy to follow, and continuous, so as not to constitute a hazard in the roadway.

The number of channelizing islands used at any intersection should be kept to a minimum and the entire layout should be the simplest design that will accomplish the desired intersection control. Usually a few carefully placed islands larger than minimum size are more effective than a greater number of small islands which create multiple channels and cause confusion.

Islands should be clearly visible at all times and from a position sufficiently in advance so that the vehicle operators will not be surprised by their presence. Islands should occupy the minimum of roadway space needed for the purpose and yet be of sufficient size to be noticeable.

The approach nose of a divisional or pedestrian refuge island which separates opposing traffic movements should be offset to the left, as faced by approaching traffic. The right curb of the island should form a diverging taper to deflect traffic toward the right. Where a channelizing or divisional island is introduced between two lanes of traffic moving in the same direction, similar offsets should be used, to the extent that space permits, on each side of the nose to direct traffic into the separate roadways.

Criteria for the design of islands are contained in A Policy on Geometric Design of Rural Highways, 1965, and A Policy on Design of Urban Highways and Arterial Streets, 1973.*

5B-2 Size and Shape

Islands generally are either narrow and elongated or triangular in shape. The size should be governed by site conditions and the function of the island. An island should be large enough to command attention.

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* Available from the American Association of State Highway and Transportation Officials, 444 North Capitol St. NW, Suite 225, Washington, D.C. 20001.

For rural conditions, triangular islands should be at least 75 square feet and preferably 100 square feet. For urban conditions where speeds are low, islands about two-thirds this size may be acceptable. Elongated islands should be not less than 4 feet wide and 20 feet long. In special cases where space is limited, elongated islands may be as narrow as 2 feet, except where used as pedestrian refuge areas, and as short as 12 feet.

Refuge islands should preferably be at least 6 feet and in no case less than 4 feet wide. The usable length along the roadway, including any section at pavement level at the crosswalk, should not be less than 12 feet or the width of crosswalk, whichever is greater.

Where possible, the width of a divisional island should be sufficient to provide a refuge area for vehicles crossing or turning at intersections, preferably 30-40 feet. The minimum desirable width of a median which will accommodate a turning lane is 16 feet. Where right-of-way is severely limited, median widths of 12 feet have been used with a 10-foot turning lane.

Generally, divisional islands should not be placed where they will confine either side of the roadway to less than two through traffic lanes, except when a short island is used on two-lane roads carrying relatively low volumes of traffic.

5B-3 Designation of Island Areas

Easy recognition of islands by approaching vehicle operators is necessary for efficient and safe operation. The forms or means of designating island areas vary, depending on their sizes, locations, and functions, and also the character of the adjacent area, rural or urban. An important consideration, in all locations, is to provide a contrast in color, and preferably texture, between islands and adjacent pavements.

Generally, islands should present the least potential hazard to approaching vehicles and yet perform their intended functions. When curbs are used, the mountable type is preferable except where a barrier curb is essential for traffic control or pedestrian refuge. Barrier curb also may be used on islands where traffic control devices are installed.

Islands may be designated as follows:

1. Raised and outlined by curbs and filled with pavement, turf, or other material.
2. Formed by pavement markings (sometimes supplemented by buttons or raised bars or flexible stanchions on all-paved areas).
3. Unsurfaced areas (sometimes supplemented by delineators, guideposts, or other devices).

Landscaping, where used, should be carefully planned to provide unrestricted visibility for vehicle operators and pedestrians. Since pedestrian refuge and channelizing islands are located in the line of the traveled-way, no physical obstructions, other than traffic control devices, should be placed in the islands.

C. APPROACH END TREATMENT

5C-1 General

The approach end of an island or group of islands must be carefully designed to provide a maximum degree of warning of the presence of the island and a definite indication of the proper vehicle path or paths to be followed. This applies to the approach to all refuge and channelizing islands and to individual divisional islands, but is not applicable to island ends at median openings on a divided street or highway and may not be necessary at secondary islands located within a multiple-island intersection.

5C-2 Method

Various methods of approach-end treatment have been used with satisfactory results: contrasting pavement colors or textures, raised bars, buttons, and median blocks. In addition to these physical changes in pavement surface, various types of illumination (sec. 5D), signing (sec. 5E) and markings (sec. 5F) are necessary to provide adequate visibility, warning, and delineation.

The ends of islands first approached by traffic should be preceded by a gradually diverging marking on the roadway surface, so as to guide vehicles into desired paths of travel along the island edge. These markings may contain slightly raised (usually less than 1 inch high) sections of coarse aggregate or other suitable material that may be crossed readily even at considerable speeds. These rumble sections provide increased visibility of the marked areas and produce an audible warning to vehicles inadvertently travelling across them.

Higher raised bars or buttons may be used in advance of islands having barrier curbs, but they should not be used where they constitute an unexpected hazard. These devices should not project more than 1 to 3 inches above the pavement surface, so that any wheel encroachment within the area will become obvious to the vehicle operator without a resultant loss of control of the vehicle. Where practical, such bars or buttons may be preceded by rumble sections, or their height should be gradually increased as approached by traffic. Pavement markings may be used with raised bars or buttons to better designate the island area.

D. ILLUMINATION

All islands and the proper channels of travel through them should be made clearly visible at night by adequate reflectorization and/or illumination. Illumination of refuge islands, including their approach-end treatment, should be sufficient to show the general layout of the island and immediate vehicular travel paths, with the greatest concentration of illumination at points of possible danger to pedestrians or vehicles, as at barrier curbs or other structures.

E. SIGNS

5E-1 General

Although safety and efficiency of operation of sections of roadways adjacent to islands depends to a considerable degree on the geometric design, the physical layout should be supplemented by effective signing as a means of informing, warning, and controlling drivers. Sign planning should be coordinated with the physical layout prior to completion of design. Signing cannot correct an improper geometric design feature.

5E-2 Application

Many standard signs (Part II) are applicable and needed because of the existence of islands.

All approach noses of islands in the line of traffic should be designated by an appropriate sign and/or marker. All signs used on islands shall be reflectorized or illuminated. Signs are to be used where the island is sufficiently wide, at least 1 foot wider than the sign. On narrower islands, a reflectorized object marker (sec. 3C-1) shall be used.

Appropriate signs for use on island approach noses are:

1. Keep Right sign (sec. 2B-25), where all through traffic is required to pass to the right of the island nose.
2. Keep Left sign (sec. 2B-25), where all through traffic is required to pass to the left of the island nose.
3. Double Arrow warning sign (sec. 2C-33), where traffic may pass to either side of the island and a special warning is needed such as at loading and refuge islands.
4. Guide signs, such as route marker assemblies or destination signs, at large intersection channelizing islands.

These signs should be placed well back from the approach nose of the island to reduce the likelihood of being struck by a vehicle. Because they are viewed from a location considerably in advance of the island, they can be set back distances up to 50-75 feet in rural areas, and yet present a proper perspective. Where posts are likely to constitute a hazard, they shall be designed to break away or yield when struck by a vehicle.

The above signs may not be necessary or even desirable at secondary islands located within a multiple-island intersection or at intermediate ends of divisional islands and medians. Object markers (sec. 3C-1), are frequently beneficial at such locations to accentuate the ends of the islands without presenting a cluttered arrangement of signs.

Usually signs will not be installed on islands designated only by painted markings on the pavement. When experience indicates that

best copy available

signing is necessary for proper roadway usage, the islands generally should be defined by curbs or means other than paint alone.

Other signs that may be necessary for the orderly flow of traffic at channelized intersections include: Turn Prohibition (sec. 2B-15), DO NOT ENTER (sec. 2B-26), WRONG WAY (sec. 2B-27), and ONE WAY (sec. 2B-29).

F. MARKINGS

5F-1 General

Definition of proper travel path of vehicles is necessary for islands to function efficiently. Reflectorized pavement markings and delineators should be provided to furnish an uninterrupted guidance system.

5F-2 Application

Markings, as related to islands, consist of pavement and curb markings, object markers and delineators.

On the approach to islands, the triangular neutral area, just in advance of the end of the island, shall include pavement markings as provided in section 3B-13. As indicated in section 5C-2, it is desirable that rumble sections (or other contrast in pavement surface) also be applied in these neutral areas. When raised bars or buttons are used, they should be marked with white or yellow reflectorizing materials, as determined by the direction(s) of travel they separate (sec. 3D-3).

5F-3 Colors

Islands, outlined by curbs or pavement markings should be marked with reflectorized white or yellow material as determined by the direction(s) of travel they separate (secs. 3B-9 and 10, 3D-3).

On very long islands, curb reflectorization need not extend for the entire length of the curb, especially if the island is illuminated or marked with delineators. It should be sufficiently long to denote the general alignment of the edge of the island along which vehicles travel, including the approach nose, when viewed from the approach to the island.

5F-4 Object Markers

Object markers (sec. 3C-1) should be used on island approach noses to indicate the presence of a raised curb or other obstruction. The marker should be used even where a sign is installed as indicated in section 5E-2. They may also be needed to define ends of other islands to make them more conspicuous at night, particularly where illumination is not provided.

5F-5 Delineators

Where delineators are used with island installations, they shall be the same color as the respective edgelines except that, when facing wrong-way traffic, they shall be red (sec. 3D-4). Each travel path through an intersection must be considered separately in positioning delineators to assure maximum effectiveness.

Part VI.
TRAFFIC CONTROLS FOR STREET AND HIGHWAY CONSTRUCTION AND MAINTENANCE OPERATIONS

A. INTRODUCTION AND GENERAL SPECIFICATIONS

6A-1 Need for Standards

Problems of traffic control occur when traffic must be moved through or around road or street construction, maintenance operations, and utility work. No one standard sequence of signs or other control devices can be set up as an inflexible arrangement for all situations due to the variety of conditions encountered.

The following treatment of signs, signals, and markings for street and highway construction and maintenance work provides a comprehensive guide to be applied as a national standard. This Part of the Manual establishes principles to be observed in the design, installation, and maintenance of traffic control devices, and prescribes standards where possible, and is designed so that it can be used independently. To that end some material concerning specifications and devices having more general application is repeated here from preceding parts of this Manual.

These principles and standards are directed to the safe and expeditious movement of traffic through construction and maintenance zones and to the safety of the work force performing these operations.

6A-2 Scope

This Part sets forth basic principles and prescribes standards for the design, application, installation, and maintenance of the various types of traffic control devices required for road or street construction, maintenance operations and utility work. These include signs, signals, lighting devices, markings, barricades, channelizing, and hand signaling devices. Minimum standards of application are prescribed for typical situations, and for methods of controlling traffic through work areas. As part of these standards, a number of typical situations are illustrated, showing the proper application of standard protective devices.

6A-3 Application of Standards

The general principles outlined in this Manual are applicable to both rural and urban areas. Since it is not practical to prescribe detailed standards of application for all the situations that may conceivably arise, minimum standards are presented here for the most common situations. It is emphasized that these are minimum desirable standards for normal situations and that additional protection must be provided when special complexities and hazards prevail. The protection prescribed for each situation shall be based on the speed and volume of traffic, duration of operation, and exposure to hazards. As used in this Part the term street refers to all the streets in any municipality, including cities, towns, villages, or other local jurisdictions.

Traffic conditions on streets are characterized by relatively low speeds, wide ranges of volumes, limited maneuvering space, frequent turns and cross movements, a significant pedestrian movement and other obstructions. Construction and maintenance operations are more numerous and varied, including such diverse activities as pavement cuts for utility work, pavement patching and surfacing, pavement marking renewal and encroachments by adjacent building construction. Work on arterial streets should be restricted to off-peak hours to minimize conflicts with traffic.

Rural highways are characterized by lower volumes, higher speeds, and less interference from pedestrians, turns, and encroachments.

Limited access highways present problems requiring a special effort by administrators, supervisors, and work forces. Both high speeds and high volumes may be anticipated, with peak flows restricting work to relatively short periods during daylight hours.

The difficulties associated with the completion of work on lanes carrying high volumes of traffic have made it necessary in some instances to schedule construction and/or maintenance operations at night. While night scheduling avoids peak flows, the problems associated with work site delineation and warning device placement are increased.

Although each situation must be dealt with individually, conformity with the provisions established herein is required. In particular situations not adequately covered by the provisions of this Manual, the protection of the traveling public, pedestrians, and of the workers on the scene will dictate the measures to be taken, consistent with the general principles set forth herein.

Early project planning for traffic control in construction areas and implementation and surveillance of these controls during construction are very important. To facilitate adequate advance project planning, the plans, specifications and estimates (PS&E) for each project should include provisions for a reasonably specific traffic control plan for moving traffic through or around the construction zone in a manner that is conducive to the safety of the traveling public, pedestrians and workers. This traffic control plan should include, but not be limited to, such items as signing; application and removal of pavement markings; construction; scheduling; methods and devices for delineation and channelization; placement and maintenance of devices; roadway lighting; traffic regulations; and surveillance and inspection.

The high conspicuity of fluorescent orange colors provides an additional margin of safety by producing a high visual impact in hazardous areas. Therefore, where the color orange is specified for use in traffic control for construction and maintenance operations, it is acceptable to utilize materials having fluorescent red-orange or yellow-orange colors.

6A-4 Responsibility

The provisions for public protection established herein are for application by (1) State highway department, county, and municipal forces performing construction or maintenance operations on roads and streets, (2) contractors employed in road or street construction or maintenance under contract to any governmental authority, and (3) all others, including employees of public utility companies, performing any work on highways or so closely adjacent as to create hazards for the public or for themselves.

These standards, as a part of the Manual on Uniform Traffic Control Devices, should be adopted by all public authorities concerned with highways, and should be given effect by official instructions to employees and by incorporation into the specifications for all contracts.

It is important that the authorities having jurisdiction be able to require proper protection, that responsibility by clearly assigned, adequate training of personnel be provided, and that there be adherence to the standards and provisions of this Manual.

6A-5 Fundamental Principles

All traffic control devices used on street and highway construction or maintenance work shall conform to the applicable specifications of this Manual.

Construction and maintenance areas can present to the motorist unexpected or unusual situations as far as traffic operations are concerned. Because of this, special care should be taken in applying traffic control techniques in these areas.

Principles and procedures which experience has shown tend to enhance the safety of motorists and workers in the vicinity of construction and maintenance work areas include the following:

1. Traffic safety in construction zones should be an integral and high priority element of every project from planning through design and construction. Similarly, maintenance work should be planned and conducted with the safety of the motorist, pedestrian, and worker kept in mind at all times.
    a. The basic safety principles governing the design of permanent roadways and roadsides should also govern the design of construction and maintenance sites. The goal should be to route

traffic through such areas with geometrics and traffic control devices as nearly as possible comparable to those for normal highway situations.

- b. A traffic control plan, in detail appropriate to the complexity of the work project, should be prepared and understood by all responsible parties before the site is occupied. Any changes in the traffic control plan should be approved by an official trained in safe traffic control practices.

2. Traffic movement should be inhibited as little as practicable.
   - a . Traffic control in work sites should be designed on the assumption motorists will only reduce their speeds if they clearly perceive a need to do so. Reduced speed zoning should be avoided as much as practicable.
   - b. Frequent and abrupt changes in geometrics, such as lane narrowing, dropped lanes, or main roadway transitions which require rapid maneuvers, should be avoided.
   - c. Provisions should be made for the safe operation of work vehicles, particularly on high speed, high volume roadways.
   - d. Construction time should be minimized to reduce exposure to potential hazards.

3. Motorists should be guided in a clear and positive manner while approaching and traversing construction and maintenance work areas.
   - a. Adequate warning, delineation, and channelization by means of proper pavement marking, signing, and use of other devices which are effective under varying conditions of light and weather should be provided to assure the motorist of positive guidance in advance of and through the work area.
   - b. Inappropriate markings should be removed to eliminate any misleading cues to drivers under all conditions of light and weather. On short term maintenance projects it may be determined that such removal is more hazardous than leaving the existing markings in place; if so, special attention must be paid to providing additional guidance by other traffic control measures.
   - c. Flagging procedures, when used, can provide positive guidance to the motorist traversing the work area. Flagging should only be employed when required to control traffic or when all other methods of traffic control are inadequate to warn and direct drivers.

4. To insure acceptable levels of operation, routine inspection of traffic control elements should be performed.
   - a. Individuals who are trained in the principles of safe traffic control should be assigned responsibility for safety at worksites. The most important duty of these individuals is to insure that all traffic control elements of the project are in conformity with the traffic

control plan and are effective in providing safe conditions for motorists, pedestrians, and workers.

b. Modification in traffic controls or working conditions may be required in order to expedite safe traffic movement and to promote worker safety. It is essential that the individual responsible for safety have the authority to control the progress of work on the project in its relation to obtaining safe conditions, including the authority to modify conditions or halt work until applicable or remedial safety measures are taken.

c. Work sites should be carefully monitored under varying conditions of traffic volume, light, and weather, to ensure that traffic control measures are operating effectively and that all devices used are clearly visible, clean, and in good repair.

d. When warranted, an engineering analysis should be made (in cooperation with law enforcement officials) of all accidents occurring within work zones. Work zones should be monitored to identify and analyze traffic accidents or conflicts. As examples, skid marks or damaged traffic control devices may indicate needed changes in the traffic control.

e. Work zone accident records should be analyzed periodically to guide officials in improving work zone operations.

f. All traffic control devices shall be removed immediately when no longer needed.

5. The maintenance of roadside safety requires constant attention during the life of the construction zone because of the potential increase in hazards.

a. To accommodate run-off-the-road incidents, disabled vehicles or other emergency situations, it is desirable to provide an unencumbered roadside recovery area that is as wide as practical.

b. Channelization of traffic should be accomplished by the use of pavement markings and signing, flexible posts, barricades, and other lightweight devices which will yield when hit by errant vehicles.

c. Whenever practical, construction equipment, materials, and debris should be stored in such a manner as not to be vulnerable to run-off-the-road vehicle impact.

6A-6 Training

Each person whose actions affect maintenance and construction zone safety—from the upper-level management personnel through construction and maintenance field personnel—should receive training appropriate to the job decisions each individual is required to make. Only those individuals who are qualified by means of adequate training in safe traffic control practices and have a basic understanding of the principles established by applicable standards and regulations, including those of the MUTCD, should supervise the selection, placement, and maintenance of traffic control devices in maintenance and construction areas.

B. SIGNS

General

6B-1 Design of Signs

Street or highway construction and maintenance signs fall into the same three major categories as do other traffic signs; namely, Regulatory signs, Warning signs, and Guide signs. Many signs normally used elsewhere will also find application for signing construction and maintenance operations. Special construction and maintenance signs follow the basic standards for all highways signs as to shape. Warning signs in construction areas shall have a black legend on an orange background. Existing yellow warning signs already in place within these areas may remain in use. Color for other signs shall follow the standard for all highway signs.

The use of stripes (other than the standard border) or other geometric patterns or contrasting colors on or around any sign in an attempt to make it more conspicuous, distracts attention from the message, and defeats the purpose of maintaining uniformity and simplicity of design. Such practice is contrary to standards and is accordingly disapproved. However, the use of standard orange flags or yellow flashing warning lights in conjunction with signs is permitted, so long as they do not interfere with a clear view of the sign face.

The dimensions of signs shown herein are for standard sizes, which may be increased wherever necessary for greater legibility or emphasis. On secondary highways and city streets smaller signs may be used if authorized by lawful authority. Deviations from standard sizes as prescribed herein shall be in six-inch increments.

Standard sign sizes and colors are shown in the illustrations of the individual signs rather than in detailed specifications in the text. Where the orange background is specified and reflectorization is not required, a fluorescent material may be used for increased daytime visibility.

6B-2 Illumination and Reflectorization

All signs intended to be used during the hours of darkness shall be either reflectorized with a material that has a smooth, sealed outer surface, or illuminated to show approximately the same shape and color day and night. Where there is serious interference from extraneous light sources and a reflectorized installation is not likely to give effective performance, an illuminated sign should be used. Sign illumination may be either internal or external. When the full face of the sign is outlined by internal illumination, thereby indicating the shape of the sign, background reflectorization is not required. Where external illumination is provided, the light source should be properly shielded to protect drivers from glare. Street or highway lighting is not regarded as meeting the requirements for sign illumination. VI-11 (c) Rev. 2

6B-3 Position of Signs

Signs shall be placed in positions where they will convey their messages most effectively and placement must therefore be accommodated to highway design and alignment. Signs shall be so placed that the driver will have adequate time for response.

As a general rule signs shall be located on the right-hand side of the street or roadway. Where special emphasis is deemed necessary, dual installations may be made which consist of duplicate signs opposite each other on the left and right sides of the roadway, respectively. Within a construction or maintenance zone, however, it is often necessary and/or desirable to erect signs on portable supports placed within the roadway iself. It is also permissible to mount appropriate signs on barricades.

Standards for height and lateral clearance of roadside signs are shown in figure 6–1. Signs mounted on barricades, or temporary supports, may be at lower heights but the bottom of the sign shall be not less than one foot above the pavement elevation. Higher mounting heights are, however, desirable.

Where open highway conditions prevail on the approach to the work site, advance warning signs should be placed approximately 1,500 feet in advance of the condition to which they are calling attention. Where a series of advance warning signs are used, the warning sign nearest the work site should be placed approximately 500 feet from the point of restriction with the additional signs at 500–1000 foot intervals. On expressway and limited access facilities, the advance warning distance should be increased to one-half mile or more. On city streets, where more restrictive conditions generally prevail on the approach to the work area, signs in the immediate vicinity of the work may be placed at closer spacings. Typical sequences and spacings of advance warning signs are shown in figures 6–2 to 6–10.

6B-4 Erection of Signs

Signs on fixed supports are usually mounted on a single post, although those wider than 36 inches or larger than 10 square feet in area should generally be mounted on two posts. Signs mounted on portable supports are suitable for temporary conditions. All such installations should be so constructed to yield upon impact to minimize hazards to motorists.

For maximum mobility on certain types of maintenance operations, a large sign may be effectively mounted on a vehicle stationed in advance of the work or moving along with it. This may be the working vehicle itself, as in the case of shoulder-mowing or pavement marking equipment, or a vehicle provided expressly for this purpose. These mobile sign displays may be mounted on a trailer, may be provided with self-contained electric power units for flashers and lights, or may be mounted on a regular maintenance vehicle.

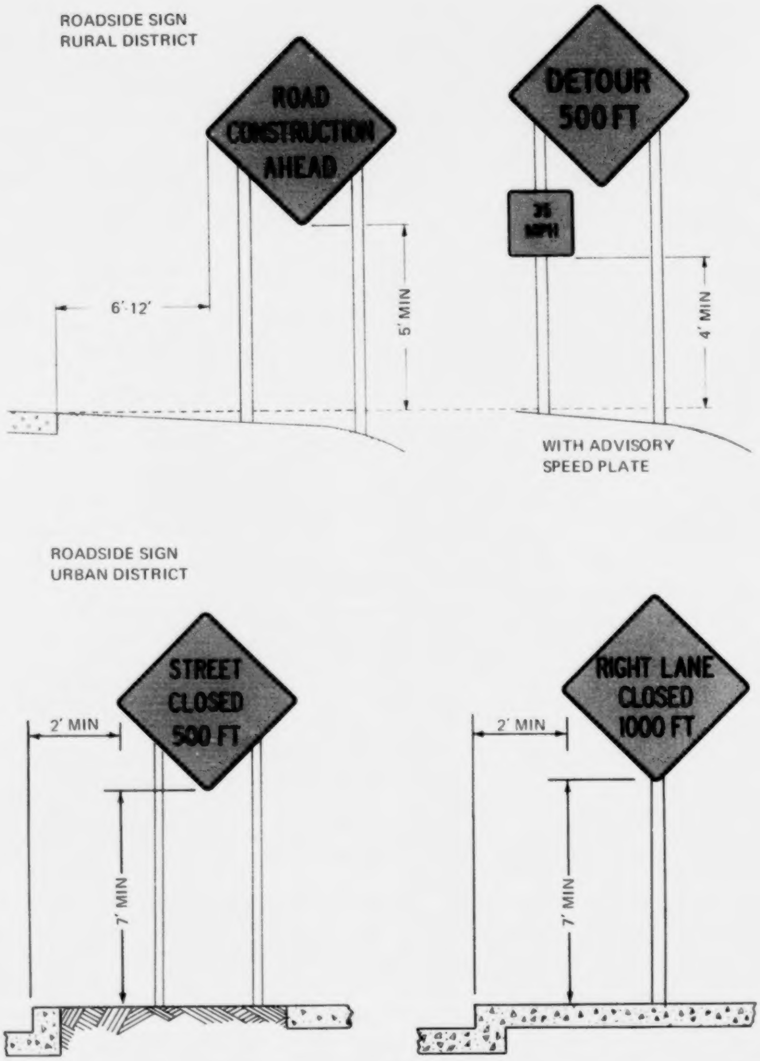
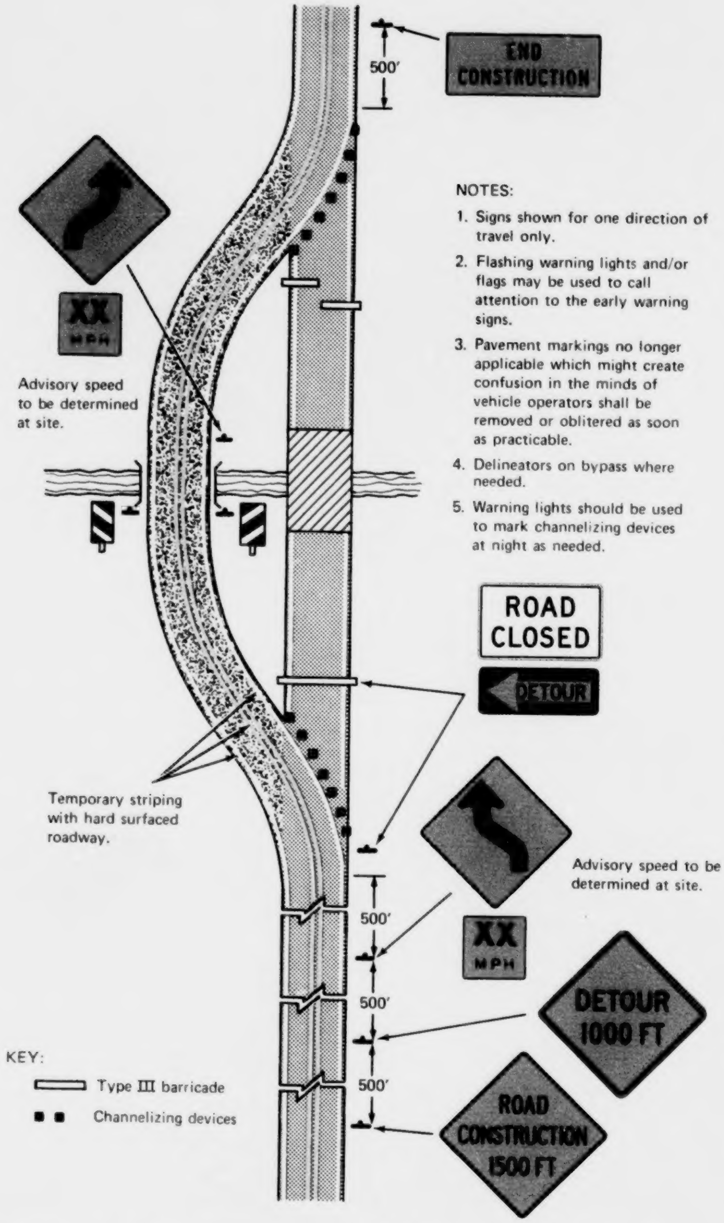

ROADSIDE SIGN
RURAL DISTRICT
ROAD CONSTRUCTION AHEAD
6'-12'
5' MIN
DETOUR 500 FT
35 MPH
4' MIN
WITH ADVISORY SPEED PLATE
ROADSIDE SIGN
URBAN DISTRICT
STREET CLOSED 500 FT
2' MIN
7' MIN
RIGHT LANE CLOSED 1000 FT
2' MIN
7' MIN

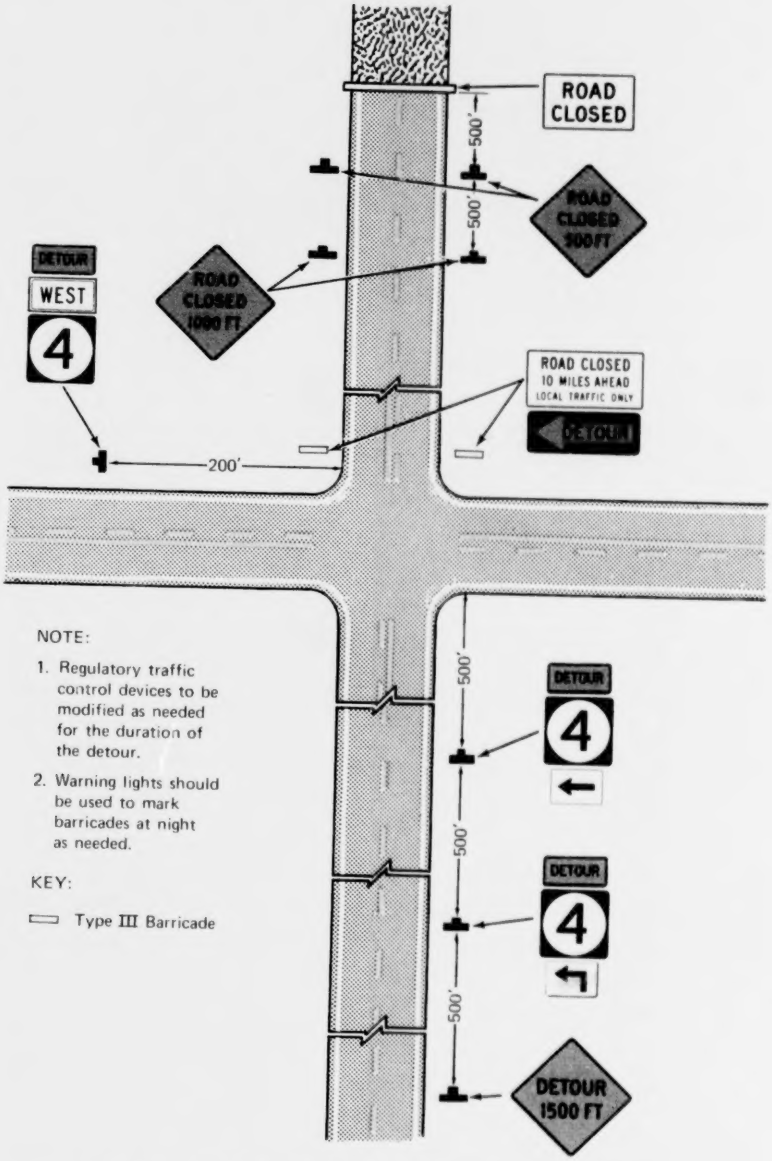
Figure 6-1. Height and lateral locations of signs—typical installation.


500′
END CONSTRUCTION
XX MPH
Advisory speed to be determined at site.
ROAD CLOSED
DETOUR
Temporary striping with hard surfaced roadway.
Advisory speed to be determined at site.
500′
XX MPH
500′
DETOUR 1000 FT
500′
ROAD CONSTRUCTION 1500 FT
KEY:
Type III barricade
▪ ▪ Channelizing devices

NOTES:

1. Signs shown for one direction of travel only.
2. Flashing warning lights and/or flags may be used to call attention to the early warning signs.
3. Pavement markings no longer applicable which might create confusion in the minds of vehicle operators shall be removed or oblitered as soon as practicable.
4. Delineators on bypass where needed.
5. Warning lights should be used to mark channelizing devices at night as needed.

Figure 6–2. Typical applications of traffic control devices on a 2-lane highway where the entire roadway is closed and a bypass detour is provided.


ROAD CLOSED
500'
ROAD CLOSED 500 FT
500'
DETOUR
WEST
4
ROAD CLOSED 1000 FT
ROAD CLOSED
10 MILES AHEAD
LOCAL TRAFFIC ONLY
DETOUR
200'
500'
DETOUR
4
500'
DETOUR
4
500'
DETOUR 1500 FT

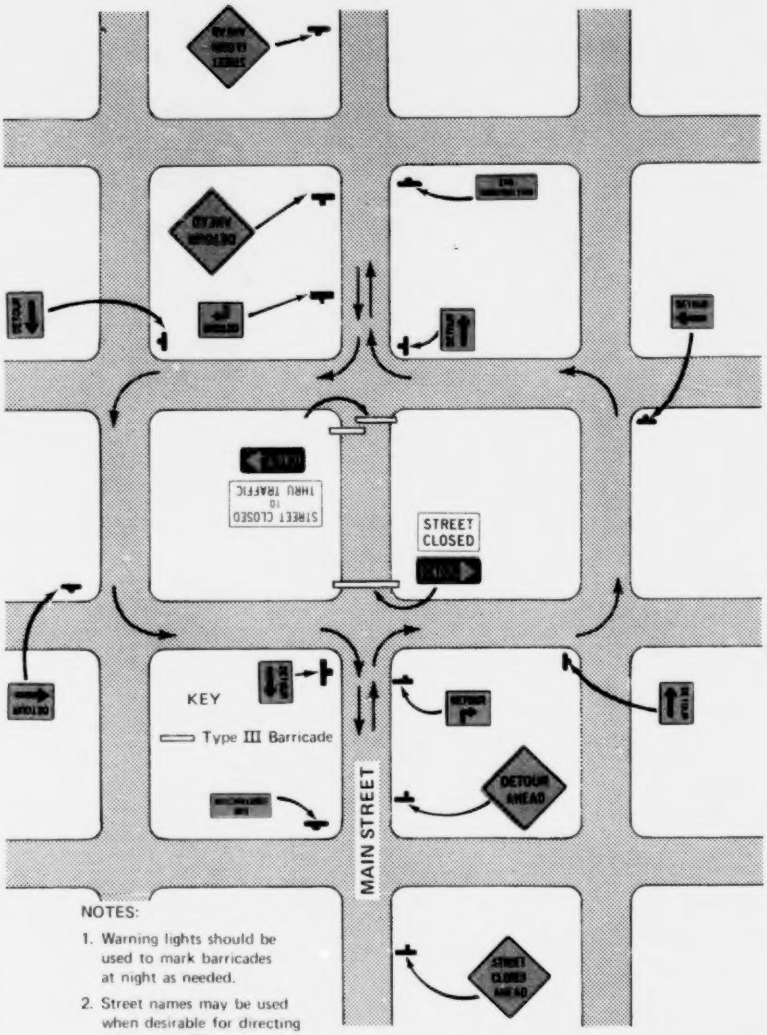
NOTE:

1. Regulatory traffic control devices to be modified as needed for the duration of the detour.
2. Warning lights should be used to mark barricades at night as needed.

KEY:

▭ Type III Barricade

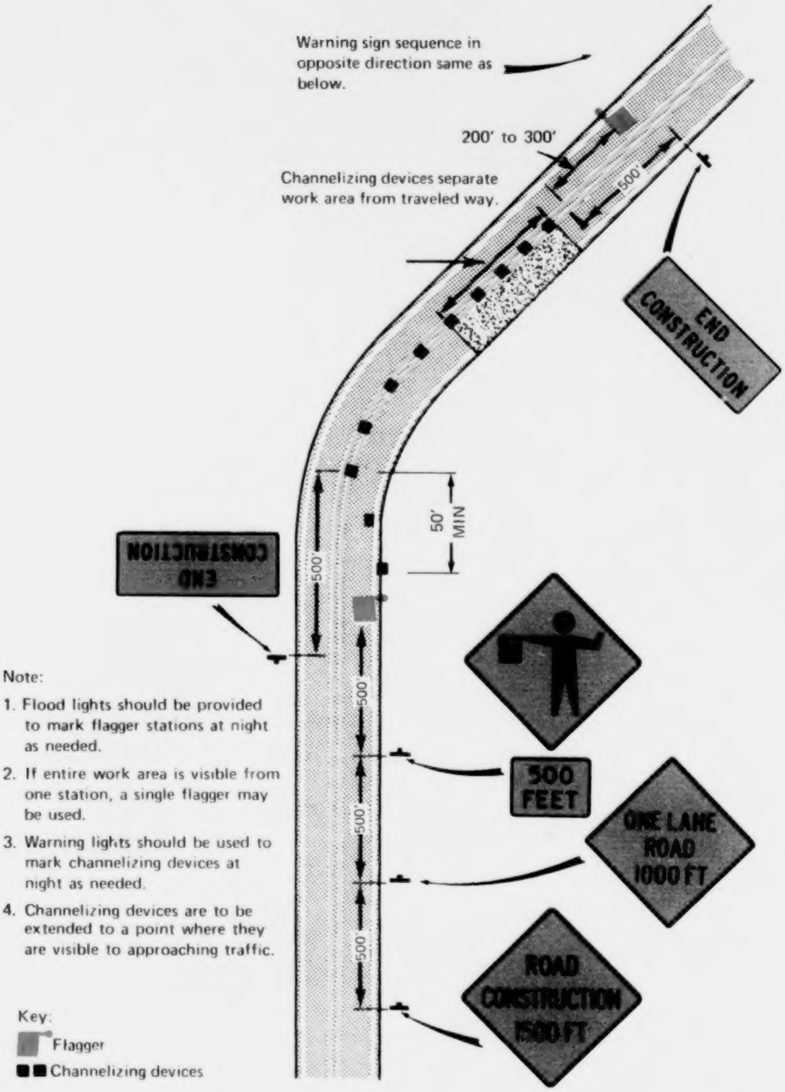
Figure 6-3. Typical application—roadway closed beyond detour point.


STREET CLOSED AHEAD
DETOUR AHEAD
END CONSTRUCTION
DETOUR
STREET CLOSED TO THRU TRAFFIC
STREET CLOSED
KEY
Type III Barricade
MAIN STREET
END CONSTRUCTION
DETOUR AHEAD
STREET CLOSED AHEAD

NOTES:

1. Warning lights should be used to mark barricades at night as needed.
2. Street names may be used when desirable for directing detoured traffic.

Figure 6-4. Typical application—detour signing for street construction project in a street grid.


Warning sign sequence in opposite direction same as below.
200' to 300'
Channelizing devices separate work area from traveled way.
500'
END CONSTRUCTION
END CONSTRUCTION
50' MIN
500'
500'
500'
500'
500 FEET
ONE LANE ROAD 1000 FT
ROAD CONSTRUCTION 1500 FT

Note:

1. Flood lights should be provided to mark flagger stations at night as needed.
2. If entire work area is visible from one station, a single flagger may be used.
3. Warning lights should be used to mark channelizing devices at night as needed.
4. Channelizing devices are to be extended to a point where they are visible to approaching traffic.

Key:

▨ Flagger

■■ Channelizing devices

Figure 6-5. Typical applications of traffic control devices on 2-lane highway where one lane is closed and flagging is provided.

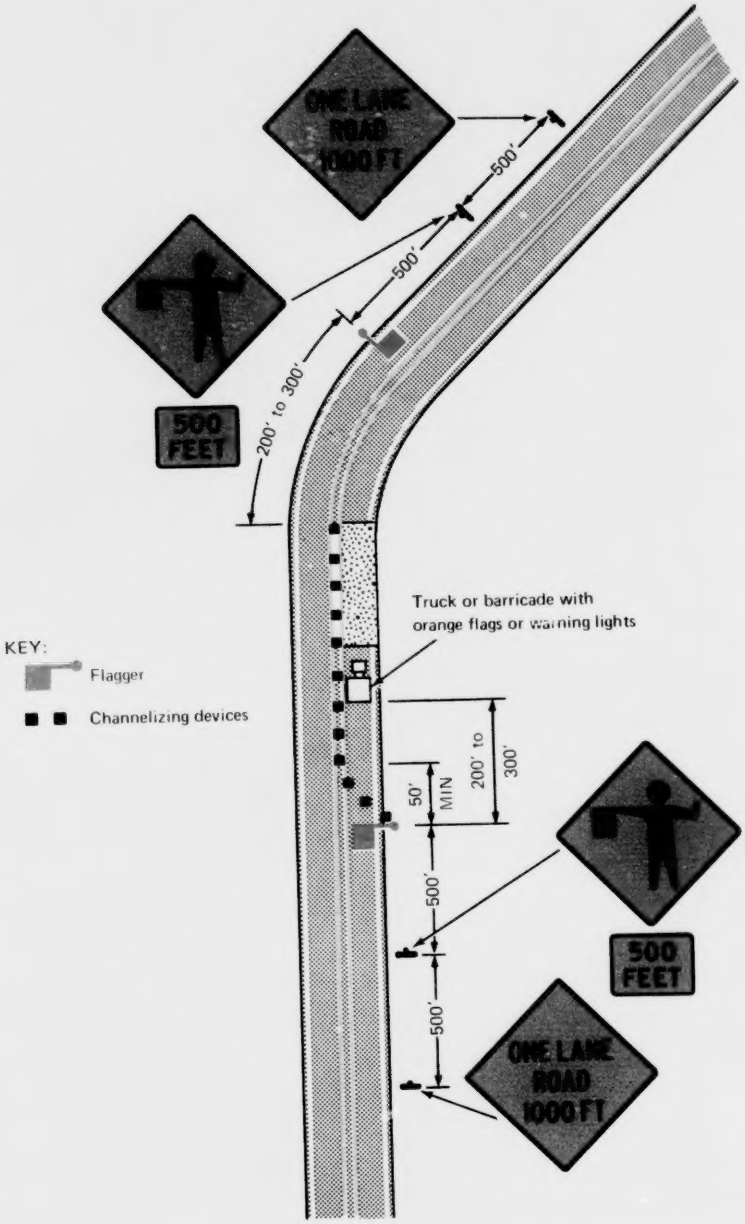
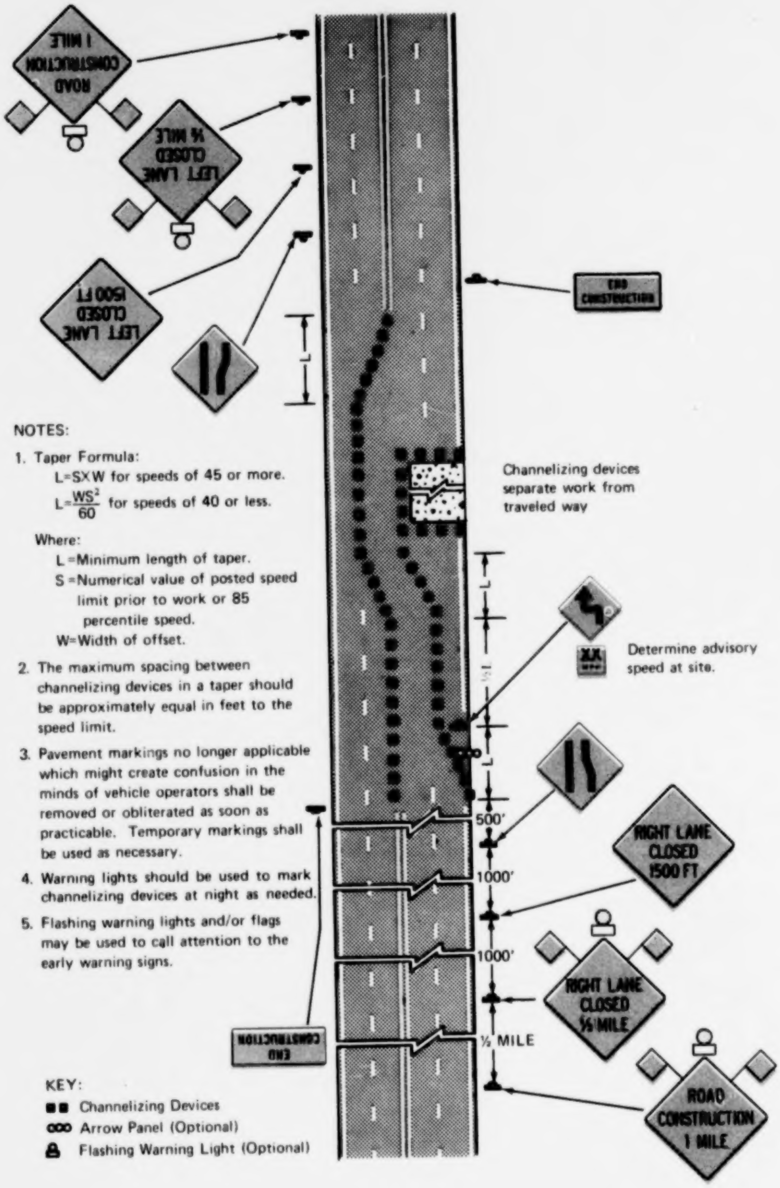

ONE LANE ROAD 1000 FT
500'
500'
500 FEET
200' to 300'
Truck or barricade with orange flags or warning lights
KEY:
Flagger
Channelizing devices
200' to 300'
50' MIN
500'
500'
500 FEET
ONE LANE ROAD 1000 FT

Figure 6-6. Typical application—daytime maintenance operations of short duration on a 2-lane roadway and flagging is provided.



ROAD CONSTRUCTION 1 MILE
LEFT LANE CLOSED ½ MILE
LEFT LANE CLOSED 1500 FT
L
END CONSTRUCTION
L
½ L
L
500'
1000'
1000'
½ MILE
XX MPH
RIGHT LANE CLOSED 1500 FT
RIGHT LANE CLOSED ½ MILE
ROAD CONSTRUCTION 1 MILE
END CONSTRUCTION

Channelizing devices separate work from traveled way

Determine advisory speed at site.

NOTES:

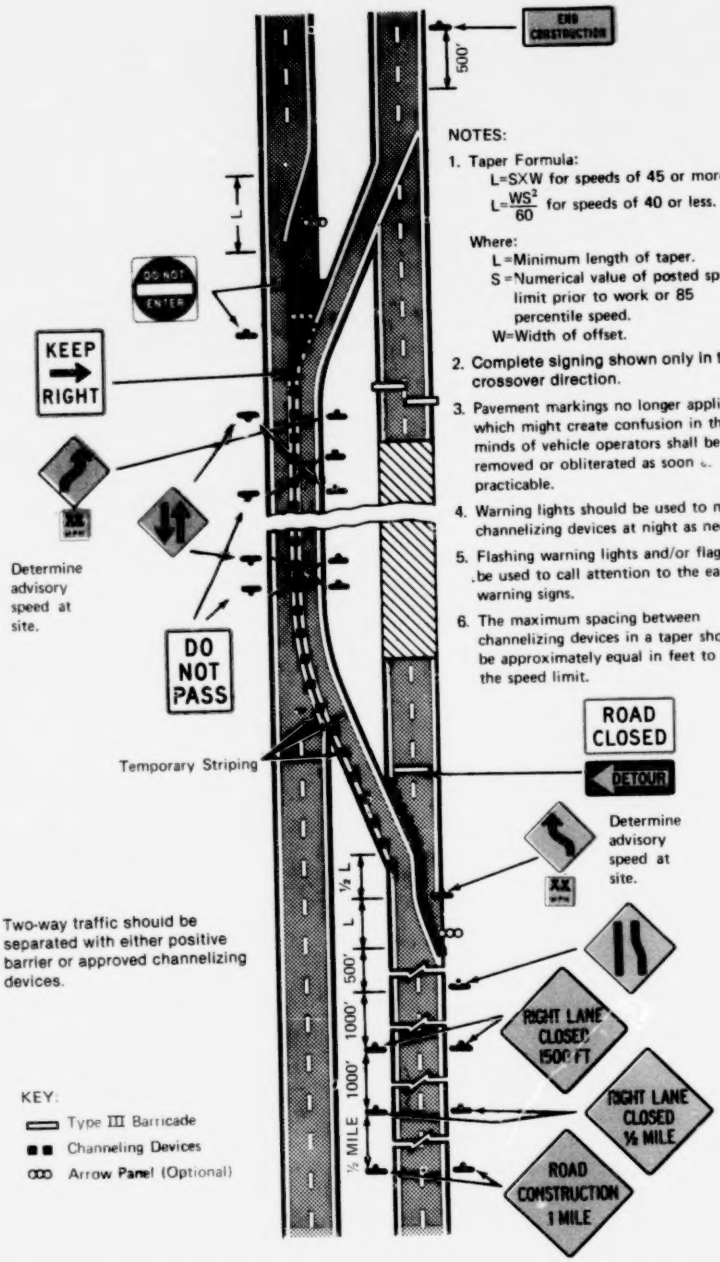
1. Taper Formula:
   $L = S \times W$ for speeds of 45 or more.
   $L = \frac{WS^2}{60}$ for speeds of 40 or less.

   Where:
   L = Minimum length of taper.
   S = Numerical value of posted speed limit prior to work or 85 percentile speed.
   W = Width of offset.
2. The maximum spacing between channelizing devices in a taper should be approximately equal in feet to the speed limit.
3. Pavement markings no longer applicable which might create confusion in the minds of vehicle operators shall be removed or obliterated as soon as practicable. Temporary markings shall be used as necessary.
4. Warning lights should be used to mark channelizing devices at night as needed.
5. Flashing warning lights and/or flags may be used to call attention to the early warning signs.

KEY:

■■ Channelizing Devices
ooo Arrow Panel (Optional)
▲ Flashing Warning Light (Optional)

Figure 6-7. Typical application—4-lane undivided roadway, where half the roadway is closed.


END CONSTRUCTION
500'
L
DO NOT ENTER
KEEP RIGHT
XX MPH
Determine advisory speed at site.
DO NOT PASS
Temporary Striping
ROAD CLOSED
DETOUR
Determine advisory speed at site.
XX MPH
½ L
L
500'
1000'
1000'
½ MILE
RIGHT LANE CLOSED 1500 FT
RIGHT LANE CLOSED ½ MILE
ROAD CONSTRUCTION 1 MILE
KEY:
Type III Barricade
Channeling Devices
Arrow Panel (Optional)

NOTES:

1. Taper Formula:
   L=SXW for speeds of 45 or more.
   $L=\frac{WS^2}{60}$ for speeds of 40 or less.

   Where:
   L = Minimum length of taper.
   S = Numerical value of posted speed limit prior to work or 85 percentile speed.
   W = Width of offset.
2. Complete signing shown only in the crossover direction.
3. Pavement markings no longer applicable which might create confusion in the minds of vehicle operators shall be removed or obliterated as soon as practicable.
4. Warning lights should be used to mark channelizing devices at night as needed.
5. Flashing warning lights and/or flags may be used to call attention to the early warning signs.
6. The maximum spacing between channelizing devices in a taper should be approximately equal in feet to the speed limit.
7. Two-way traffic should be separated with either positive barrier or approved channelizing devices.

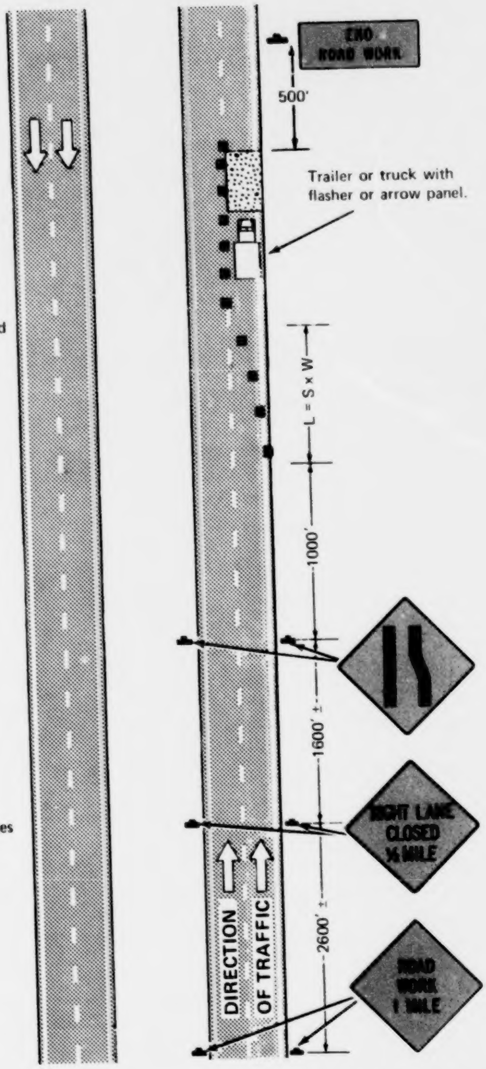
Figure 6-8. Typical application—4-lane divided roadway where one roadway is closed.

NOTES:

1. Taper Formula:
   $L = S \times W$ for speeds of 45 or more.
   $L = \frac{WS^2}{60}$ for speeds of 40 or less.

   Where:
   L=Minimum length of taper.
   S=Numerical value of posted speed limit prior to work or 85 percentile speed.
   W=Width of offset.

2. The maximum spacing between channelizing devices in a taper should be approximately equal in feet to the speed limit.


END
ROAD WORK
500'
Trailer or truck with flasher or arrow panel.
L = S x W
1000'
1600' ±
RIGHT LANE
CLOSED
½ MILE
2600' ±
ROAD
WORK
1 MILE
DIRECTION
OF TRAFFIC

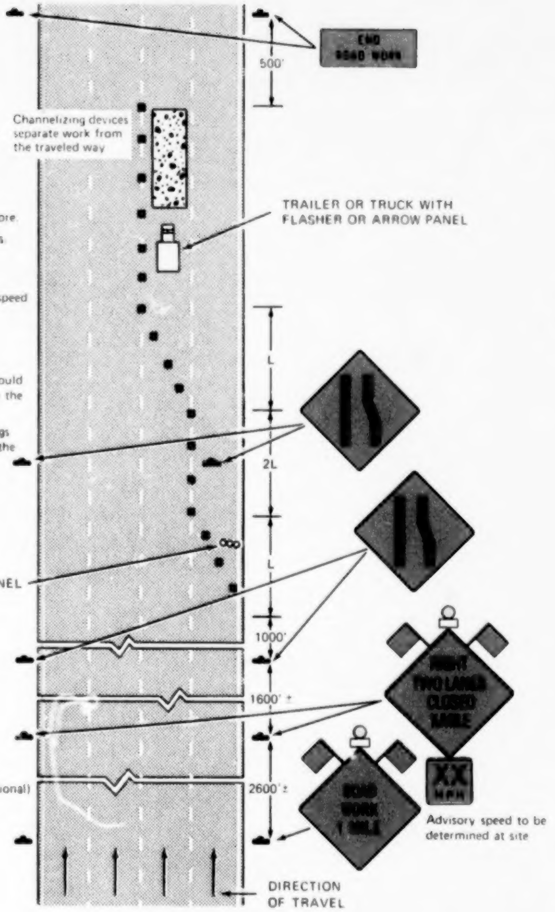
KEY:
■ ■ Channelizing devices

Figure 6-9. Typical application—daytime maintenance operations of short duration on a 4-lane divided roadway where half of roadway is closed.

NOTES:

1. Taper Formula:
   $L = S \times W$ for speeds of 45 or more.
   $L = \frac{WS^2}{60}$ for speeds of 40 or less.

   Where:
   L = Minimum length of taper.
   S = Numerical value of posted speed limit prior to work or 85 percentile speed.
   W = Width of offset.
2. The maximum spacing between channelizing devices in a taper should be approximately equal in feet to the speed limit.
3. Flashing warning lights and/or flags may be used to call attention to the early warning signs.


END ROAD WORK
500'
Channelizing devices separate work from the traveled way
TRAILER OR TRUCK WITH FLASHER OR ARROW PANEL
L
2L
L
ARROW PANEL
1000'
1600' ±
RIGHT TWO LANES CLOSED ½ MILE
XX MPH
2600' ±
ROAD WORK 1 MILE
DIRECTION OF TRAVEL

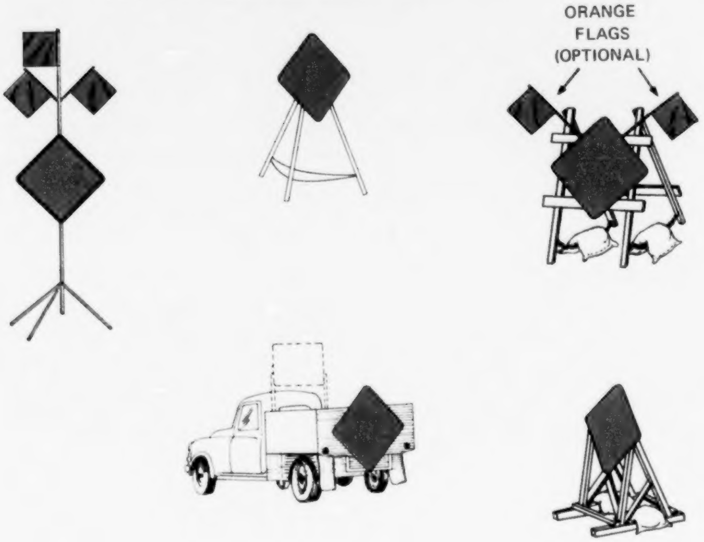
Advisory speed to be determined at site

KEY:

■ ■ Channelizing devices
ooo Arrow Panel (Optional)
Flashing Warning Light (Optional)

Figure 6-10. Typical application—closing multiple lanes of a multilane highway.

PORTABLE AND TEMPORARY MOUNTINGS


ORANGE FLAGS (OPTIONAL)

WING BARRICADES

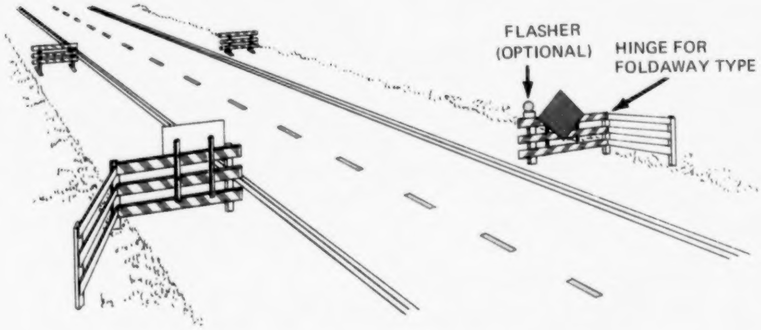

FLASHER (OPTIONAL)
HINGE FOR FOLDAWAY TYPE

Figure 6-11. Methods of mounting signs other than on posts.

Guide signs, although ordinarily erected on separate posts, may also be mounted on or above barricades, but should not be permitted to interfere with the effectiveness of necessary regulatory and warning signs.

Typical methods of mounting signs other than on posts are shown in figure 6-11.

Regulatory Signs

6B-5 Authority

Regulatory signs impose legal obligations and/or restrictions on all traffic. It is essential, therefore, that their use be authorized by the public body or official having jurisdiction and that signs conform with this Manual.

6B-6 Design

Regulatory signs are generally rectangular with their longer dimension vertical, and carry a black legend and border on a white background. The STOP sign is octagonal, and has a white legend and border on a red background. The YIELD sign is a white inverted triangle with red legend and border band. The DO NOT ENTER sign consists of a white square on which is inscribed a red circle with a white band horizontally across the center of the circle and the words DO NOT and ENTER in white letters on the upper and lower parts of the circle. The ONE-WAY sign may be either a horizontal or vertical rectangular plate, the latter being used more commonly in cities where space is limited. Commonly used regulatory signs are illustrated in figure 6-12. Design details for all regulatory signs are given in Part II.

6B-7 Application

Construction and maintenance operations represent unusual roadway conditions and warrant special attention. If construction or maintenance operations require regulatory measures different from those normally in effect, the existing permanent regulatory devices shall be removed or covered and superseded by the appropriate temporary regulatory sign, taking into account applicable ordinances or statutes of the jurisdiction involved.

6B-8 Road (Street) Closed Sign (R11-2)

The ROAD (STREET) CLOSED sign shall be used where the roadway is closed to all traffic except contractors' equipment and officially authorized vehicles and should be accompanied by appropriate detour signing. The sign should be erected at or near the center of the roadway on

VI-26 (c)
Rev. 4

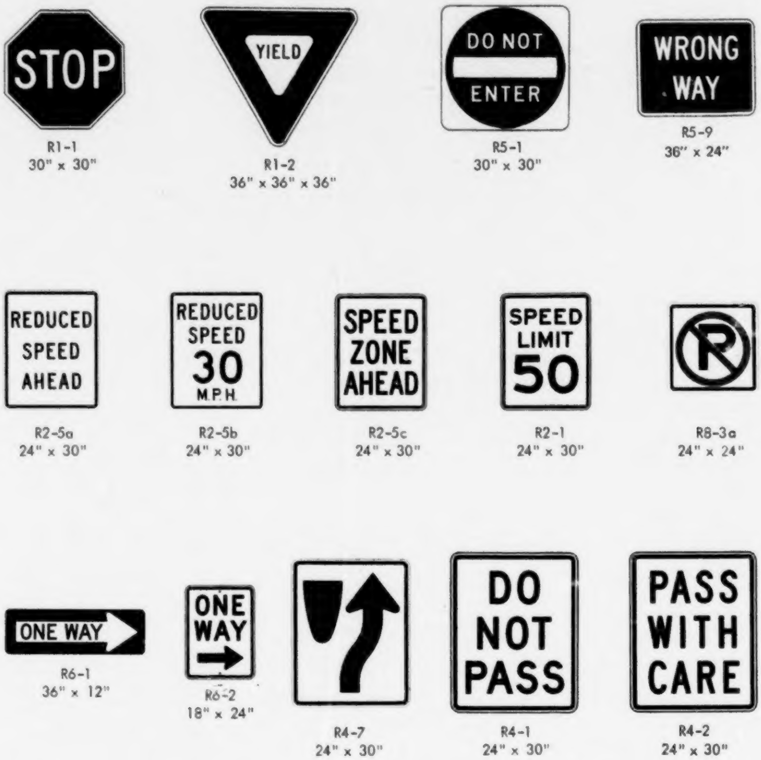

STOP
R1-1
30" x 30"
YIELD
R1-2
36" x 36" x 36"
DO NOT
ENTER
R5-1
30" x 30"
WRONG
WAY
R5-9
36" x 24"
REDUCED
SPEED
AHEAD
R2-5a
24" x 30"
REDUCED
SPEED
30
M.P.H.
R2-5b
24" x 30"
SPEED
ZONE
AHEAD
R2-5c
24" x 30"
SPEED
LIMIT
50
R2-1
24" x 30"
R8-3a
24" x 24"
ONE WAY
R6-1
36" x 12"
ONE
WAY
R6-2
18" x 24"
R4-7
24" x 30"
DO
NOT
PASS
R4-1
24" x 30"
PASS
WITH
CARE
R4-2
24" x 30"

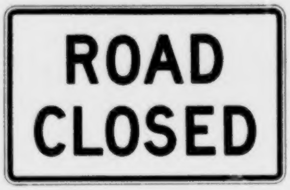
Figure 6-12. Commonly used regulatory signs.

or above a barricade that closes the roadway (sec. 6C-9). Because it is the last sign the driver will see before he must stop or turn, it is essential that it be large and legible. It shall have a standard, and minimum, size of 48 inches by 30 inches.

The ROAD (STREET) CLOSED sign shall not be used where traffic is maintained or where the actual closure is some distance beyond the sign and local traffic is permitted access to nearer points. In the latter case the Local Traffic Only sign (sec. 6B-9) should be used.

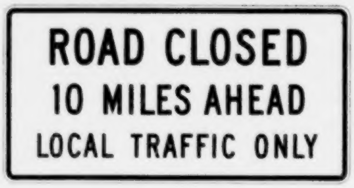
6B-9 Local Traffic Only Signs (R11-3, R11-4)

The Local Traffic Only sign should be used where through traffic must detour to avoid a closing of the road or street some distance beyond, but

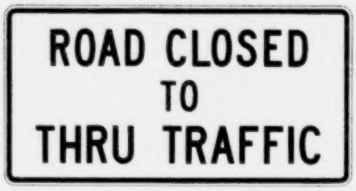


R11-2
48" x 30"

where the road or street is open for traffic up to the point of closure. It shall carry the legend ROAD CLOSED (10) MILES AHEAD—LOCAL TRAFFIC ONLY or, optionally for urban use, STREET CLOSED TO THRU TRAFFIC and should be accompanied by appropriate detour signing (fig. 6-4, page 6B-6). The words BRIDGE OUT may be substituted for ROAD CLOSED where applicable. IV-26(c) Rev. 4



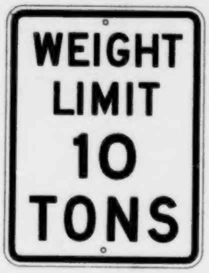
R11-3
60" x 30"



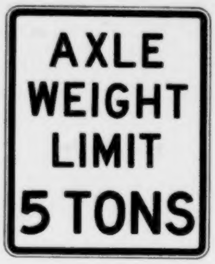
R11-4
60" x 30"

6B-10 Weight Limit Signs (R12-1, R12-2)

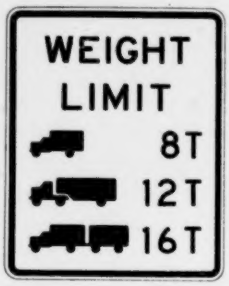
For traffic safety in areas of road or street construction and maintenance, a Weight Limit sign shows the gross weight or axle weight that can be permitted on a roadway surface or bridge. Weight restrictions must be consistent with State or local regulations and shall not be imposed without the approval of the authority having jurisdiction over the highway. When weight restrictions are imposed, a marked detour should be provided for vehicles whose legal weight exceeds the limit posted.



R12–1
24" x 30"



R12–2
24" x 30"



R12–5
30"×36"

6B–11 Special Regulatory Signs

Various other regulatory signs may be called for by special operations located in or around the roadway. Although it is not practicable to standardize many such signs in detail, they should conform to the general requirements pertaining to color and shape. Their messages should be brief, legible, and clearly understandable.

Warning Signs

6B–12 Function

Warning signs for construction and maintenance projects are used to notify drivers of specific hazards which may be encountered, when those operations are underway. Within the construction zone there may be a variety of temporary roadway facilities. Pavement width may be reduced. Open excavations may be present in or near the roadway, or travel across an unpaved section may be required. Drivers should be properly alerted to possible dangers ahead in sufficient time to adjust their speed for the hazard.

6B–13 Design and Application

Warning signs for construction and maintenance shall be diamond shaped (square with one diagonal vertical), having a black symbol or message on an orange background except as provided for herein.

Construction or maintenance operations on freeway or expressway facilities, may also require large movable warning signs. Mounting considerations for some of these signs may justify a change from the standard diamond shape to a rectangular shape, but such variances should have prior approval of the appropriate highway authority.

The square Advisory Speed plate (sec. 6B-34) shall have a black message and border, and shall have an orange background when used in conjunction with an orange background sign and shall have a yellow background when used with a yellow background sign. It shall have a minimum 24x24 inches size when used with a 36x36 inches sign or larger.

Detailed specifications are given only for signs prescribed for construction and maintenance work and for some of the standard signs that are commonly required for these work areas.

On secondary roads or city streets where speeds are low, the use of plates 6 inches smaller on a side than the standard size, but not less than 24 inches, may be used for warning signs having short word messages or clear symbols.

Where distances are to be shown on warning signs as part of the legend, a separate panel with the distance shown thereon may be erected immediately below the sign on the same support.

Where any part of the roadway is obstructed or closed, construction approach warning signs are required to alert traffic well in advance of these obstructions or restrictions to normal traffic flow (sec. 6B-14). These signs may be used singly or in combination. Because of their importance, these signs shall have a standard size of 48 inches by 48 inches and shall be the standard diamond shape for warning signs, except as provided for above.

Where speeds and volumes are relatively low, a minimum size of 36 inches by 36 inches may be used for Construction Approach Warning Signs, provided that a minimum letter size of 5 inches can be accommodated on this size with the appropriate legend.

6B-14 Application of Construction Approach Warning Signs

Various circumstances will occur which will require extra advance warning because of limited sight distance or the nature of the obstruction may require a motorist to bring his vehicle to a stop. Therefore, specified standards or a set sequence of signs are not noted. The determination of the sign or signs to be used shall be on the basis of an engineering study using the following sections as guidelines (sec. 6B-15 through 6B-20). As an alternate to the specific distances on these advance construction signs, the word AHEAD may be used.

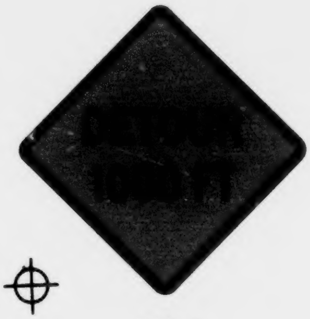
6B-15 Advance Road (Street) Construction Sign (W20-1)

The Advance Road (Street) Construction sign is to be located in advance of the initial activity or detour a driver may encounter, and is intended for use as a general warning of obstructions or restrictions. It carries the legend ROAD (STREET) CONSTRUCTION (1,500) FT or ROAD (STREET) CONSTRUCTION (½) MILE. It may be used in repetition with appropriate legends, or in conjunction with other construction signs.

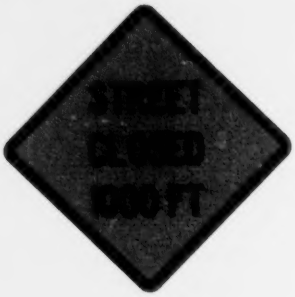
W20-1
48" x 48"

6B-16 Advance Detour Sign (W20-2)

The Advance Detour sign is intended for use in advance of a point at which traffic is diverted over a temporary roadway or route. It carries the legend DETOUR (1,500) FT or DETOUR (½) MILE. It may be used with repetition with appropriate legends or in conjunction with other construction signs.



W20-2
48" x 48"



W20-3
48" x 48"

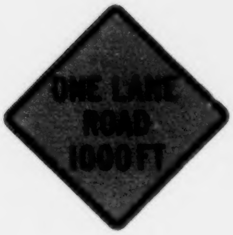
6B-17 Advanced Road (Street) Closed Sign (W20-3)

The Advance Road (Street) Closed sign is intended for use in advance of a point at which a roadway is closed to all traffic or to all but local traffic. It carries the legend ROAD (STREET) CLOSED (1,000) FT or ROAD (STREET) CLOSED (¼) MILE. It may be used in repetition with appropriate legends or in conjunction with other construction signs.

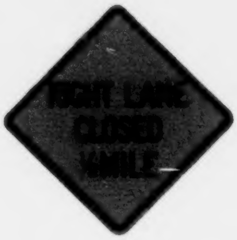
6B-18 Advance One Lane Road Sign (W20-4)

The Advance One Lane Road sign is intended for use only in advance of a point where traffic in both directions must use a single lane (secs. 6F-6 and 7). It carries the legend ONE LANE ROAD (1,000) FT or ONE LANE ROAD (¼) MILE. It may be used in repetition with appropriate legends or in conjunction with other construction signs.

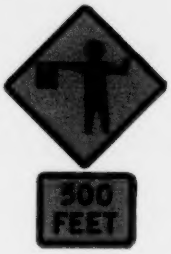
If the one-lane stretch is of such length as not to be visible throughout from either end, or if the traffic is of such volume that simultaneous arrivals at both ends occur frequently, provision must be made to permit traffic to move alternately under control (secs. 6F-6 to 6F-10).



W20-4
48" x 48"



W20-5
48" x 48"



W20-7a
36" x 36"
Supplemental Plate
24" x 18"

6B-19 Advance Lane Closed Sign (W20-5)

The Advance Lane Closed sign is intended for use where applicable in advance of a point where one lane of a multiple-lane roadway is closed (sec. 6G-3). It carries the legend RIGHT (LEFT) LANE CLOSED (1,000) FT or RIGHT (LEFT) LANE CLOSED (¼) MILE. It may be used in repetition with appropriate legends or in conjunction with other construction signs.

6B-20 Advance Flagger Sign (W20-7)

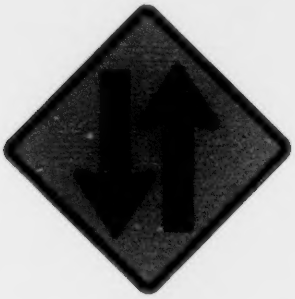
The Advance Flagger sign is intended for use in advance of any point at which a flagger has been stationed to control traffic through a construction or maintenance project. It carries the flagger symbol. When needed, an appropriate distance message may be displayed on a supplemental plate below the symbol sign. It may be used in repetition with appropriate revisions in the supplemental distances plate or in conjunction with other construction signs.

The word message sign W20-7 with appropriate distances may be used as an alternate to the W20-7a flagger symbol sign.

The sign shall be promplty removed, covered, or turned to face away from the roadway whenever the flagger is not at the station.

6B-21 Two-Way Traffic Sign (W6-3)

Two-Way Traffic sign should be used as needed at intervals to periodically remind drivers that they are on a two-way highway which contains opposing traffic.



W6-3
48" x 48"

6B-22 Application of Maintenance and Minor Construction Warning Signs

At many maintenance and minor construction operations, particularly on lightly traveled roads, there may be no need for the sequence of Construction Approach Warning signs prescribed for major operations. The signs described in the following sections and on figures 6-13a and 6-13b, will ordinarily provide sufficient advance warning in such situations, either by themselves or in combination with appropriate Construction Approach Warning signs, as dictated by conditions. In addition, some of them may be needed inside the limits of a major work area where traffic is maintained through the job.

6B-23 Worker Sign (W21-1)

A Worker sign is intended for use in conjunction with minor maintenance and public utility operations for the protection of workers in or near the roadway. On low-speed urban roads a worker sign is intended for use at limited obstruction sites which are adequately marked and clearly visible, such as an open manhole with a fence around it. The W21-1 word message sign may be used as an alternate to the W21-1a Worker Symbol sign.

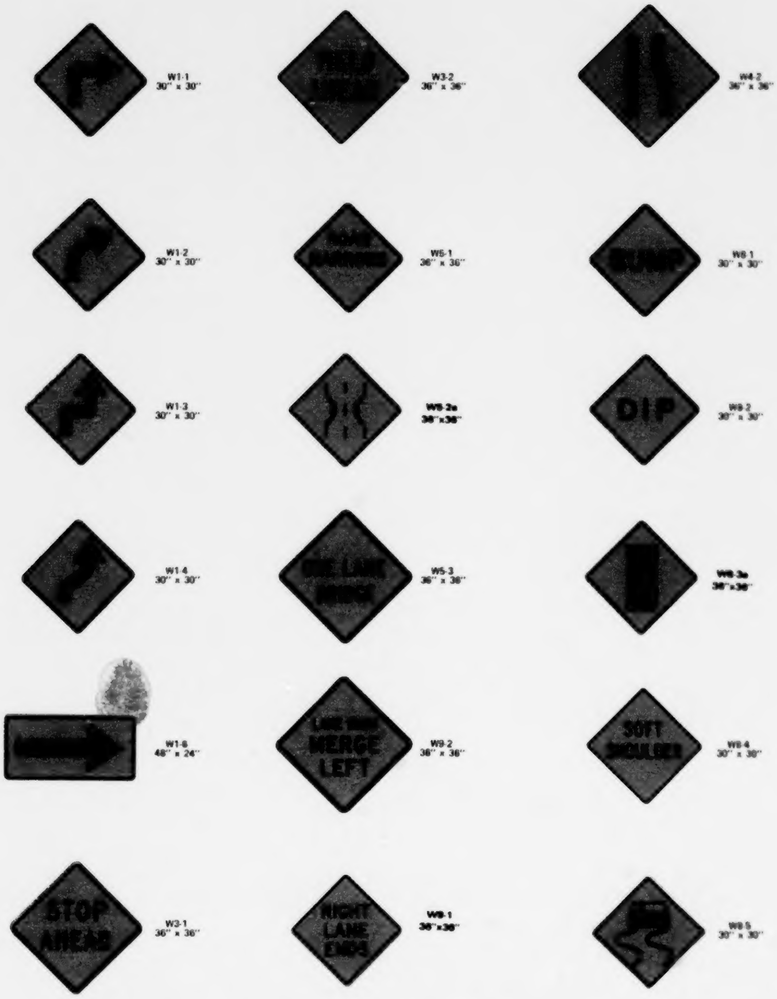
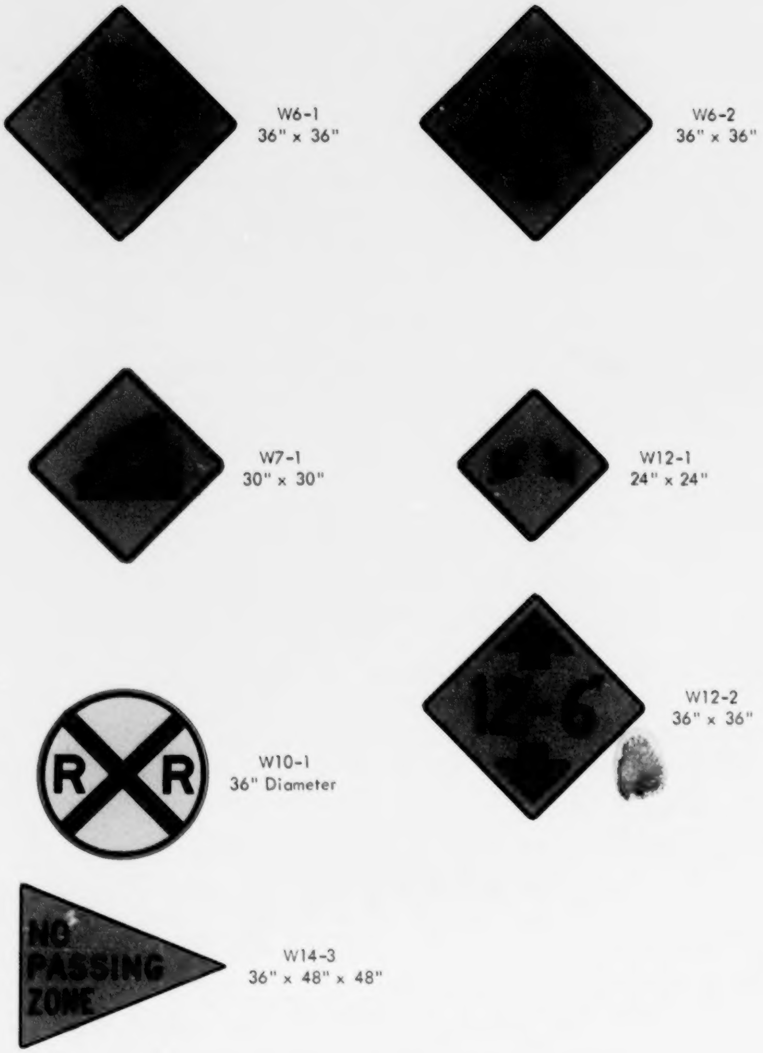

W1-1
30" x 30"
W3-2
36" x 36"
W4-2
36" x 36"
W1-2
30" x 30"
W5-1
36" x 36"
BUMP
W8-1
30" x 30"
W1-3
30" x 30"
W5-2a
36"x36"
DIP
W8-2
30" x 30"
W1-4
30" x 30"
W5-3
36" x 36"
W8-3a
36"x36"
W1-6
48" x 24"
MERGE
LEFT
W9-2
36" x 36"
SOFT
SHOULDER
W8-4
30" x 30"
STOP
AHEAD
W3-1
36" x 36"
RIGHT
LANE
ENDS
W9-1
36"x36"
W8-5
30" x 30"

Figure 6–13a. Warning signs used in construction areas.


R
R
NO
PASSING
ZONE

W6-1
36" x 36"

W6-2
36" x 36"

W7-1
30" x 30"

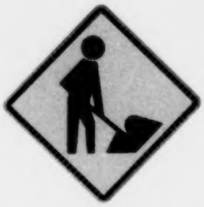
W12-1
24" x 24"

W12-2
36" x 36"

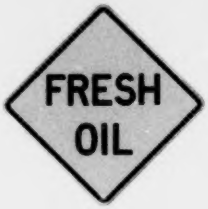
W10-1
36" Diameter

W14-3
36" x 48" x 48"

Figure 6-13b. Warning signs used in construction areas.



W21-1a
36" x 36"



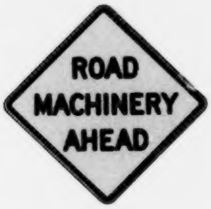
W21-2
30" x 30"

6B-24 Fresh Oil Sign (W21-2)

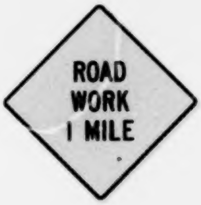
The FRESH OIL (TAR) sign is intended for use to warn motorists that resurfacing operations have rendered the surface of the pavement temporarily hazardous, and that objectionable splashing on vehicles may occur.

6B-25 Road Machinery Sign (W21-3)

The ROAD MACHINERY sign is intended for use in areas where heavy equipment is operating in or adjacent to the roadway.



W21-3
36" x 36"



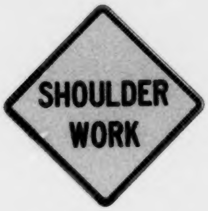
W21-4
36" x 36"

6B-26 Road Work Sign (W21-4)

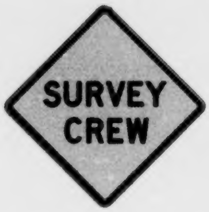
The ROAD WORK sign is intended for use in advance of maintenance or minor reconstruction operations in the roadway (fig. 6-9, page 6B-11).

6B-27 Shoulder Work Sign (W21-5)

The SHOULDER WORK sign is intended for use in advance of maintenance or minor reconstruction operations involving the shoulder, where the traveled way remains unobstructed.



W21-5
30" x 30"



W21-6
30" x 30"

6B-28 Survey Crew Sign (W21-6)

The SURVEY CREW sign is intended for use in advance of a point where a surveying crew is working in or adjacent to the roadway.

6B-29 Signs for Blasting Areas

As sources of radio-frequency (RF) energy can cause the premature firing of electric blasting caps used in construction operations, the public must be warned of such conditions and, as a part of the overall safety precautions, be advised to turn off mobile radio transmitters. From a practical standpoint, however, the possibility of a premature explosion is extremely remote due to the necessary combination of circumstances that is very unlikely to occur in actual practice. There does not appear to be a radio-frequency (RF) initiation hazard in the normal storage and transportation of electric blasting caps as long as they are in their original cartons.

The Institute of Makers of Explosives Publication No. 20, "Radio Frequency Energy, A Potential Hazard in the Use of Electric Blasting Caps," should be consulted for information on this hazard and guidelines for safe operations. [1] This publication provides tables of recommended safe distances which will give the blaster a high degree of assurance that his blasting layout should be safe against radio frequency (RF) initiation.

As a precautionary measure a sequence of signs is recommended for use to remind operators of mobile radio equipment to turn off transmitters when in a blasting area. The maximum power for amateur radio mobile units being 1,000 watts, a minimum safe distance of 1,000 feet is recommended for warning sign placement to satisfy the worst condition. Occasionally, situations may develop where adherence to the 1,000 foot distance or to the tables in Publication No. 20 will create an operational handicap. In these instances it is recommended that competent experts be consulted to evaluate the particular situation.

Recommended practices for warning sign application follow.

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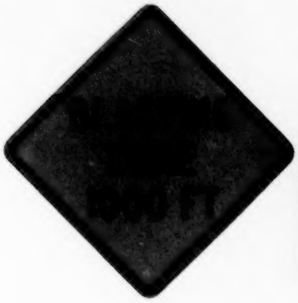
[1] Radio Frequency Energy, "A Potential Hazard in the Use of Electric Blasting Caps," Publication No. 20, Institute of Makers of Explosives, 420 Lexington Avenue, New York, New York 10017.

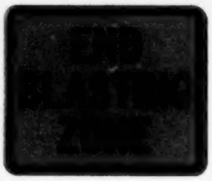
6B-30 Blasting Zone Sign (W22-1)

The BLASTING ZONE (1,000) FT sign is intended for use in advance of any point or work site where there are explosives being used. The TURN OFF 2-WAY RADIO and END BLASTING ZONE signs must be used in sequence with this sign. Provision shall be made for covering or removing the sign sequence when there are no explosives in the area or the area is otherwise secured.



W22-1
48" x 48"

W22-2
42" x 36"



W22-3
42" x 36"

6B-31 Turn Off 2-Way Radio Sign (W22-2)

The TURN OFF 2-WAY RADIO sign is to be used in sequence with the BLASTING ZONE (1,000) FT and END BLASTING ZONE sign and placed at least 1,000 feet from the beginning of the blasting zone. These signs shall be prominently displayed and covered or removed when there are no explosives in the area or the area is otherwise secured.

6B-32 End Blasting Zone Sign (W22-3)

The END BLASTING ZONE sign is to be used to denote the end of the danger zone and shall be placed a minimum of 1,000 feet from the blasting zone, either with or preceding the END CONSTRUCTION sign.

6B-33 Other Warning Signs

In addition to the warning signs specifically related to construction and maintenance operations there are numerous other warning signs, standardized for general use and treated in Part II of this Manual, that may find application in work areas. These include the following:

1. Large Arrow (W1-6)
2. ROAD NARROWS (W5-1)
3. Divided Highway Ends (W6-2)
4. BUMP (W8-1)
5. DIP (W8-2)
6. Pavement Ends (W8-3)
7. SOFT SHOULDER (8-4)

8. TRUCK CROSSING (W8-6)
9. LOOSE GRAVEL (W8-7)
10. ROUGH ROAD (8-8)
11. Low Shoulder (W8-9)
12. BE PREPARED TO STOP
13. Chevron Panels.

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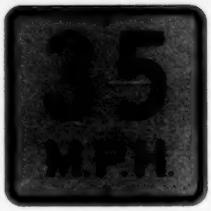
The application of most of these signs is prescribed in detail in Part II of this Manual, although their application is generally apparent from their legends. When used in construction operations, these signs shall have an orange background and when used in highway maintenance operations, they should have an orange background.

6B-34 Advisory Speed Plate (W13-1)

In conjunction with a warning sign, an Advisory Speed plate may be used to indicate a maximum recommended speed through the hazardous area. For use with orange construction and maintenance signs this plate shall have a black legend on an orange background and when used with yellow background warning signs shall have a yellow background.



W13-1
18" x 18"
24" x 24"

Except in emergencies, an Advisory Speed plate shall not be erected until the recommended speed has been determined by the authority in charge of the highway.

Guide Signs

6B-35 Function and Design of Information and Guide Signs

The following informational signs are required at construction and maintenance sites:

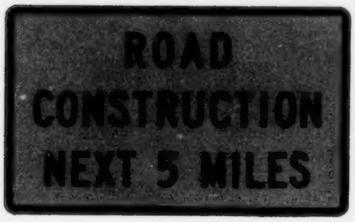
1. Standard route markings, to the extent that temporary route changes are necessary.

2. Directional signs and street name signs, when used in conjunction with detour routing may have a black legend on an orange background.

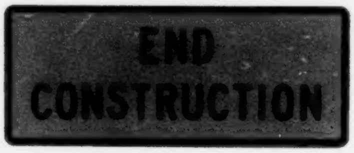
3. Special information signs (secs. 6B-36 to 39) relating to the work being done. These signs shall have a black message on an orange background.

6B-36 Length of Construction Sign (G20-1)

The Length of Construction sign shall be erected at the limits of any road construction or maintenance job of more than 2 miles in extent, where traffic is maintained through the job. It carries the legend ROAD CONSTRUCTION NEXT (5) MILES. It can be effectively mounted on a wing barricade. This sign may be used where required, for jobs of lesser length or on urban streets with appropriate distances shown.



G20-1
60" x 36"



G20-2
60" x 24"

6B-37 End Construction (Road Work) Sign (G20-2)

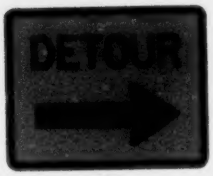
The END CONSTRUCTION (ROAD WORK) sign should be erected approximately 500 feet beyond the end of a construction or maintenance job. It may be erected on the back of a warning sign set up facing the opposite direction of traffic or on the back of a wing barricade. Where appropriate, the legend END ROAD WORK may be used.

6B-38 Detour Signs and Markers (M4-8, 9, and 10)

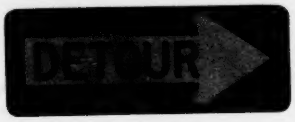
The Detour Arrow sign (4-10) is used at a point where a detour roadway or route has been established due to the closure of a street or highway to through traffic. It should normally be mounted just below the ROAD CLOSED sign (sec. 6B-8) or the Local Traffic Only sign (sec. 6B-9).

The Detour Arrow sign uses a horizontal arrow pointed to the right or left as required at each location.

Each detour shall be adequately marked with standard temporary route markers and destination signs as a responsibility of the highway agency. The Detour marker (M4-8) (sec. 2D-24) mounted at the top of a route marker assembly is to be used to mark a temporary route that branches from a regular numbered route, bypasses a section of a route which is closed or



M4-9R
30" × 24"



M4-10R
48" × 18"

blocked by construction, major maintenance, roadway damage or traffic emergency and rejoins the regularly numbered route beyond that section. The Detour sign (M4–9) (sec. 2D–25) is to be used for unnumbered routes; for use in emergency situations; for periods of short durations; or where, over relatively short distances, it is not necessary to show route markers to guide traffic along the detour and back to its desired route. A Street Name sign may be placed above or incorporated in the Detour sign (M4–9) to indicate the name of the roadway for which the detour was established.

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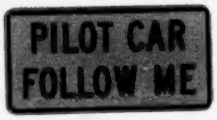
The End Detour sign (M4–8a or M4–8b) may be used to advise the motorist that the detour has ended. The End Detour sign may be used on either numbered highways or unnumbered roadways. If used on a numbered highway, it should be erected above a route marker located near the end of the detour.

VI-16 (c)
Rev. 2

6B–39 Pilot Car Sign (G20–4)

The Pilot Car sign shall be mounted in a conspicuous position on the rear of a vehicle used for guiding one-way traffic through or around a road construction or maintenance project (sec. 6F–9). It carries the legend PILOT CAR—FOLLOW ME. A flagger must be stationed on every approach to a project on which a pilot car is used, to hold traffic as necessary until the pilot car is available to lead.



G20-4
36" × 18"

C. BARRICADES AND CHANNELIZING DEVICES

6C-1 Function

The function of channelizing devices are to warn and alert drivers of hazards created by construction or maintenance activities in or near the traveled way, and to guide and direct drivers safely past the hazards. Channelizing devices as used herein includes but is not limited to cones, vertical panels, drums, barricades, and barriers.

Devices used for channelization should provide a smooth and gradual transition in moving traffic from one lane to another, onto a bypass or detour, or in reducing the width of the traveled way. They should be constructed so as not to inflict any undue damage to a vehicle that inadvertently strikes them. The objective should be the development of a traffic control plan which uses a variety of traffic control measures and devices in whatever combination necessary to assure smooth, safe vehicular movement past the work area and at the same time provide safety for the equipment and the worker on the job.

Channelizing devices are elements in a total system of traffic control devices for use in highway construction and maintenance operations. These elements shall be preceded by a subsystem of warning devices that are adequate in size, number, and placement for the type of highway on which the work is to take place. Typical application of channelizing devices are shown in Figure 6-2 to 6-10. VI-30(c) Rev. 4

6C-2 Channelization

The single most important element, within the system of traffic control devices commonly used in construction or maintenance areas (where a reduction in pavement width is involved), is the taper that is provided for the channelization. An inadequate taper will almost always produce undesirable traffic operations with resulting congestion and possibly accidents through the area.

The minimum desirable taper length for construction and maintenance purposes should be computed by the formula $L = S \times W$, for all freeways, expressways, and other roadways having a posted speed of 45 mph or greater. The formula $L = WS^2/60$ should be used to compute taper length on urban, residential and other streets where the posted speeds are 40 mph or less. Under either formula, L equals the taper length in feet, W the width of offset in feet, and S the posted speed or off-peak 85 percentile speed.

The minimum desirable length derived from the appropriate formula above applies to roadway conditions of relatively flat grades and straight alignment. Adjustments may become necessary to provide adequate sight distance on the approach to the channelization. Similarly, the proximity of interchange ramps, crossroads, etc., to the work site may dictate the need for adjustments. In general, better traffic operations will result when the adjustments consist of increasing the length of the taper rather than reducing the length (below the minimum desirable recommended above).

The real test concerning adequate length of taper is the operation of vehicles through the transition. It should be long enough so that drivers of vehicles approaching side by side have sufficient length in which to adjust their respective speeds and merge into a single lane before the end of the transition. A brief period of observing driver performances will generally provide some clear indications of the adequacy of the taper length. For example, if severe brake applications are observed, an increased taper length is indicated.

The maximum spacing between devices in a taper should be approximately equal in feet to the speed limit. For example, if the taper is on a roadway with an existing 55 MPH speed limit, the devices should be spaced about 55 feet. Devices placed on a tangent to keep traffic out of the closed lane should be spaced in accordance with the extent and type of activity, the speed limit of the roadway, and the vertical and horizontal alignment of the roadway such that it is apparent the roadway is closed to traffic.

On construction projects, channelization often remains in the same place for long periods of time. During such a long interval some of the elements—cones, barricades, barrels, etc.—get out of their original alignment due to being struck, moved due to construction activities, etc. It is necessary, therefore, to patrol the channelization at regular intervals to assure its proper functioning as a traffic control device. Replacement or shifting of the elements into the original alignment can best be done if the original positions of the elements had been indicated on the pavement by paint marks. This technique assures good alignment and proper vehicle performances over a long period of time with minimum expenditure of men and materials in maintaining the channelization.

Sometimes during maintenance operations, work at one site will extend over several days, thereby requiring that channelization be set up each morning and removed each evening. Under these circumstances the locations of the cones, barrels, etc., should be marked at the time of the original set-up to facilitate the rapid, orderly re-setting of the devices on each succeeding day.

6C-3 Cone Design

Traffic cones and tubular markers of various configurations are available. These shall be a minimum of 18 inches in height with a broadened base and may be made of various materials to withstand impact without damage to themselves or to vehicles. Twenty-eight inches should be the minimum height of cones used on freeways and other high-speed roadways and on all facilities during hours of darkness or whenever more conspicuous guidance is needed. Orange shall be the predominant color on cones. They should be kept clean and bright for maximum target value. For nighttime use they shall be reflectorized or equipped with lighting devices for maximum visibility. Reflectorized material shall have a smooth, sealed outer surface which will display the same approximate color day and night. VI-25(c) Rev. 4

Reflectorization of tubular markers shall be a minimum of two three-inch white bands placed a maximum of 2″ from the top with a maximum of 6″ between the bands. Reflectorization of cones shall be provided by a minimum 6″ white band placed a maximum of 3″ from the top. VI-12 (c) Rev. 2

6C-4 Cone Application

Included under this heading are a group of devices whose primary function is the channelization of traffic. They may be conical in shape, but there are also tubular shaped devices available capable of performing the same function. They may be set on the surface of the roadway or rigidly attached for continued use.

Traffic cones may be easily stacked on a truck and one worker can carry and distribute several cones with ease. This mobility and flexibility (which cannot be equalled by Type I barricades) increases the usefulness of these devices.

When cones are used, precautions are necessary to assure they will not be blown over or displaced. This may be particularly critical adjacent to lanes of moving traffic where there may be a wind created by passing vehicles. Some cones are constructed with bases that may be filled with ballast. With others it may be necessary to double the cones or use heavier weighted cones, special weighted bases, or weights such as sand bag rings that can be dropped over the cones and onto the base to provide increased stability. These added weights should not be sufficient to present a hazard if the devices are inadvertently struck.

In general, traffic cones have a greater target value than do the tubular shaped devices. However, the target value of either device may be enhanced during the day time by the insertion of an orange flag in the top and at night, by reflectorization or the use of lighting devices.

6C-5 Vertical Panel—Design and Application

Vertical panels used as channelizing or warning devices shall be 8 to 12 inches in width and a minimum of 24 inches in height. They shall be orange and white striped and reflectorized in the same manner as barricades and mounted with the top a minimum of 36 inches above the roadway. For panels less than 3′ in height, 4″ stripes shall be used. If used for traffic in two directions, back to back panels shall be used. These devices may be used for traffic separation or shoulder barricading where space is at a minimum.

Panels with stripes which begin at the upper right side and slope downward to the lower left side are to be designated as 'right' panels (VP-1R). Panels with stripes which begin at the upper left side and slope downward to the lower right side are to be designated as 'left' panels (VP-1L).

For nighttime use, it is desirable to place flashing warning lights on vertical panels when they are used singly and steady burn warning lights on vertical panels when they are used in a series for channelization.

6C-6 Drum Design

Drums used for traffic warning or channelization shall be approximately 36″ in height and a minimum of 18″ in diameter. The markings on drums shall be horizontal, circumferential, orange and white reflectorized stripes four to eight inches wide, using a material that has a smooth, sealed outer surface which will display the same approximate size, shape and color day and night.

There shall be at least two orange and two white stripes on each drum. If there are nonreflectorized spaces between the horizontal orange and white stripes, they shall be no more than two inches wide.

6C-7 Drum Application

Drums are most commonly used to channelize or delineate traffic flow but may also be used singly or in groups to mark specific hazards. Drums are highly visible and have good target value, give the appearance of being formidable obstacles and, therefore, command the respect of drivers. They are portable enough to be shifted from place to place within a construction project in order to accommodate changing conditions but are generally used in situations where they will remain in place for a prolonged period of time. When drums are placed in the roadway, appropriate advance warning signs shall be used.

Drums should not be weighted with sand, water, or any material to the extent that would make them hazardous to motorists. When they are used in regions susceptible to freezing, they should have drain holes in the bottom so water will not accumulate and freeze causing a hazard if struck by a motorist.

During hours of darkness a flashing warning light should be placed on drums used singly and steady-burn warning lights should be placed on drums used in a series for traffic channelization.

Small arrow signs or vertical panels mounted above drums may be used as supplements to drum delineation.

6C-8 Barricade Design

A barricade is a portable or fixed device having from one to three rails with appropriate markings used to control traffic by closing, restricting, or delineating all or a portion of the right-of-way.

Barricades shall be one of three types: Type I, Type II, or Type III. The characteristics of these types are shown in Figure 6-14 and Table VI-1.

Barricades with stripes which begin at the upper right side and slope downward to the lower left side are to be designated as 'right' (R) barricades. Barricades with stripes which begin at the upper left side and slope downward to the lower right side are to be designated as 'left' (L) barricades.

Markings for barricade rails shall be alternate orange and white stripes (sloping downward at an angle of 45 degrees in the direction traffic is to pass).

Where a barricade extends entirely across a roadway, it is desirable that the stripes slope downward in the direction toward which traffic must turn in detouring. Where both right and left turns are provided for, the chevron striping may slope downward in both directions from the center of the barricade.

Barricade rails should be supported in a manner that will allow them to be seen by the motorist and provide a stable support not easily blown over by the wind or traffic. For Type I barricades, the support may include other unstriped horizontal panels necessary to provide stability. To facilitate rapid identification of channelizing devices on a job site, the name and phone number only of an agency, contractor, or supplier may be shown on the nonreflective surface of the face part of a barricade. Such identification shall be in one color and nonreflective with letters not to exceed 1-inch in height. **VI-28(c) Rev. 4**

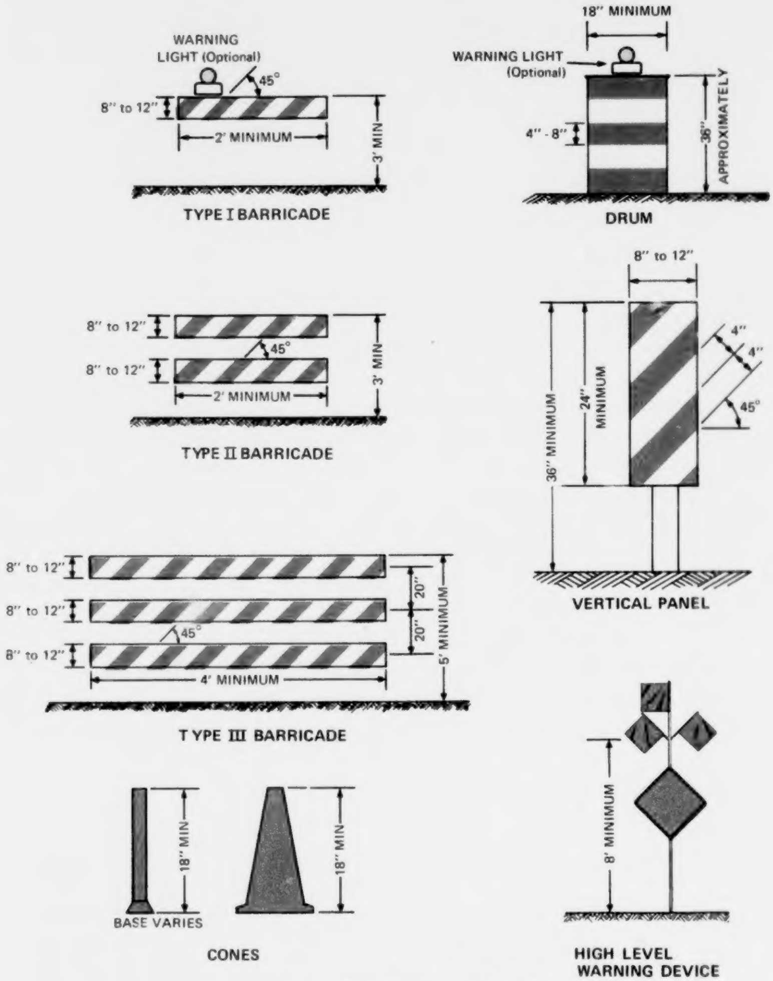
The entire area of orange and white shall be reflectorized with a material that has a smooth, sealed outer surface which will display the same approximate size, shape and color day and night. **VI-23(c) Rev. 4**

Table VI-1 Barricade Characteristics

	*Type**		
	I	*II*	*III*
Width of Rail	8″ min-12″ max	8″ min-12″ max	8″ min-12″ max
Length of Rail	2 ft. min	2 ft. min	4 ft. min
Width of Stripes**	6 in.	6 in.	6 in.
Height	3 ft. min	3 ft. min	5 ft. min.
Number of Reflectorized Rail Faces	2 (one each direction)	4 (two each direction)	3 if facing traffic in one direction 6 if facing traffic in two directions

* For wooden barricades nominal lumber dimensions will be satisfactory

** For rails less than 3 feet long, 4 inch wide stripes shall be used


18" MINIMUM
WARNING LIGHT (Optional)
45°
8" to 12"
2' MINIMUM
3' MIN
TYPE I BARRICADE
WARNING LIGHT (Optional)
4" - 8"
36" APPROXIMATELY
DRUM
8" to 12"
45°
8" to 12"
2' MINIMUM
3' MIN
TYPE II BARRICADE
8" to 12"
4"
4"
45°
36" MINIMUM
24" MINIMUM
VERTICAL PANEL
8" to 12"
8" to 12"
8" to 12"
45°
20"
20"
5' MINIMUM
4' MINIMUM
TYPE III BARRICADE
18" MIN
18" MIN
BASE VARIES
CONES
8' MINIMUM
HIGH LEVEL WARNING DEVICE

Note: Flashing or steady burn warning lights should be used on barricades, panels, and drums as needed.

Figure 6-14. Channelizing devices and high level warning devices.

Barricades are located adjacent to traffic and therefore subject to impact by errant vehicles. Because of their vulnerable position and the possible hazard they could create, they should be constructed of lightweight materials and have no rigid stay bracing for "A" frame designs.

6C-9 Barricade Application

Type I or Type II barricades are intended for use in situations where traffic is maintained through the area being constructed and/or reconstructed. They may be used singly or in groups to mark a specific hazard or they may be used in a series for channelizing traffic. Type I barricades would normally be used on conventional roads or urban streets and arterials. As Type II barricades have more reflective area, they are intended for use on expressways and freeways or other high speed roadways.

On high speed expressways or in other situations where barricades may be susceptible to overturning in the wind, sandbags should be used for ballasting. Sandbags may be placed on lower parts of the frame or stays to provide the required ballast but shall not be placed on top of any striped rail.

Where maintenance activities are being performed, a street or highway condition is seldom of a character that will require a complete closing of the facility. When such a condition does occur, it is almost always an emergency situation, as would result from a broken water main or a washed-out culvert, for example. Repair work is generally initiated on an emergency basis and the street or road closing generally is of a kind wherein Type I is used.

On construction projects, when a road section is closed to traffic, Type III barricades shall be erected at the points of closure. They may extend completely across a roadway and its shoulders or from curb to curb. Where provision must be made for access of equipment and authorized vehicles, the Type III barricades should be provided with gates or movable sections that can be closed when work is not in progress, or with indirect openings that will discourage public entry. Where access is provided through the Type III barricades, responsibility should be assigned to a person to assure proper closure at the end of each working day.

When a road or street is legally closed, but access must still be allowed for local traffic, the Type III barricade cannot be erected completely across a roadway. Instead, an arrangement should be devised that will permit local use but effectively discourage use by through traffic. A sign with the appropriate legend concerning permissible use by local traffic shall be installed. Applications of this principle are illustrated in figures 6-3 and 6-4 (pages 6B-5 and 6B-6).

Wing barricades are a special application of Type III barricades, erected on the roadway shoulder (on one or both sides of the pavement) to give the illusion of a narrowed or restricted roadway. In advance of a construction or maintenance area, even where no part of the roadway is actually closed, wing barricades serve a useful purpose in alerting the driver. If used in a series, they should start at the outer edge of the shoulder and be brought progressively closer to the pavement. Wing barricades may be used as a mounting for the advance warning or guide signs or lighting devices. During periods of inactivity, a foldaway type of design may be advantageous. Examples of wing barricades are shown in figure 6-11.

Signs may be erected on barricades, particularly those of the fixed type, and they offer a most advantageous facility for this purpose. The ROAD CLOSED and Detour Arrow signs, and the Large Arrow warning signs, for example, can effectively be mounted on or above the barricade that closes the roadway.

Construction and maintenance zones often encroach into sidewalks or crosswalks necessitating provisions for alternate routing. Where it is not possible to close a path and divert the pedestrians to other walkways, barricades may be used to define the path. Flashers should be used on sidewalk barricades in accordance with the following paragraph however, where high levels of illumination exist for sidewalk areas the use of flashers on barricades may not be needed.

For nighttime use, it is desirable to add flashing warning lights when barricades are used singly and steady burn lights when barricades are used in a series for channelization.

6C-10 Portable Barrier—Design and Application

Barriers are highway appurtenances designed to prevent vehicular penetration from the travelway to areas behind the barrier such as to minimize damage to impacting vehicles and their occupants. They may also be used to separate two-way traffic.

Portable barriers are barriers that are capable of being moved from one site to another. These devices may be constructed of concrete, metal, or any material that will act to physically deter access of vehicles from certain portions of the right-of-way.

Barriers may serve an additional function of channelizing traffic; however, their use should be determined by engineering analysis and the protective requirements of the location, not the channelizing needs. When serving the additional function of channelizing traffic, portable barriers should be of a light color for increased visibility. For nighttime use, barriers shall be supplemented by the use of standard delineation or channelization markings or devices.

Barricade warning lights may be installed on continuous barriers. On each side of the roadway only the first two yellow warning lights at the start of a continuous barrier may be Type A flashing. Subsequent warning lights on the barrier shall be Type C yellow steady-burning for channelization.

The effect of impacting the ends of barriers should be mitigated. Such mitigating measures include the use of crash cushions or flaring the ends of barriers away from the travelway.

6C-11 High Level Warning Device—Design and Application

High level warning devices are used to supplement other controls and devices necessary to alert motorists of construction and maintenance activities or obstructions in the roadway and are designed so as to be seen over the top of preceding vehicles.

They shall consist of a minimum of three flags with or without a Type B High Intensity Flashing Warning Light. The distance from the roadway to the bottom of the lens of the light and/or the lowest point of all three flags shall be no less than 8 feet. The flags shall be 16 inches square or larger and shall be orange or fluorescent red-orange in color.

High level warning devices are most commonly used in urban high density traffic situations to warn motorists of operations such as pavement patching, manhole work, surveying, utility work, etc.

D. MARKINGS

6D-1 Pavement Markings Applications

When construction work necessitates the utilization of vehicle paths other than the lanes normally used, daytime and nighttime drive-through checks should be made to evaluate the path and the possibility that the pavement markings might inadvertently lead drivers from the intended path. Markings no longer applicable which might create confusion in the minds of vehicle operators shall be removed or obliterated as soon as practicable. Ideally, inappropriate existing pavement markings should be removed and the new delineation placed before opening the affected lane or lanes to traffic. Traffic shifts from one path to another should not be attempted unless there is sufficient time, equipment, materials and personnel available to properly complete it before the end of the workday.

Conflicting pavement markings must be obliterated to prevent confusion to vehicle operators. Proper pavement marking obliteration leaves a minimum of pavement scars and completely removes old pavement paint. Painting over existing stripes is not considered to meet the requirements for removal or obliteration. The intended vehicle path should be clearly defined during day, night, and twilight periods under both wet and dry pavement conditions.

Where stage construction requires changes in barricades or channelization, similar day-night checks and evaluations of the existing pavement marking should accompany each change. When temporary roadway is constructed to bypass a closed portion of highway, appropriate reflectorized pavement markings shall be placed on the approach to, and throughout the length of hard-surfaced temporary roadways. At locations where the duration of the temporary roadway is relatively short, pavement markings consisting of reflectorized paint lines may not be practical due to the time required and expense involved in their removal.

Under the above conditions, adequate short-term expendable pavement markings can be provided by use of pressure sensitive traffic marking tape or raised pavement markers. Either of these types of devices can be applied simply and quickly and can be removed with little or no difficulty when changing traffic patterns make the installation obsolete.

Temporary pavement markings shall be used in combination with appropriate warning signs, channelizing devices and delineation to clearly indicate the required vehicle paths.

Where maintenance activities are being performed, the use of pavement markings generally has little application. Normal maintenance work is considered to be that type of work which would be accomplished within one or more continuous workshifts with the worksite being protected by an adequate complement of warning signs, flagger and channelizing devices to indicate the proper vehicle path. Longer term maintenance work should, for the purpose of traffic handling through the worksite, be treated as a "construction" project.

6D-2 Delineators

Delineation in construction and maintenance zones is intended to be a guide to indicate the alignment of the roadway and outlines the required vehicle path through these areas. Delineators are not to be used as a warning device.

Delineators are reflector units capable of clearly reflecting light under normal atmospheric condition from a distance of 1000 feet when illuminated by the upper beam of standard automobile lights. Reflective elements for delineators shall have a minimum dimension of approximately 3 inches.

Delineator applications in construction or maintenance areas, should always be made in combination with some of the other traffic control devices discussed in Part VI-C.

Delineators, when used, shall be mounted on suitable supports so that the reflecting unit is about 4 feet above the near roadway edge. The standard color for delineators used along the right side of streets and highways shall be white. The color of delineators used along the left edge of divided streets and highways and one-way roadways shall be yellow. Spacing along roadway curves should be such that several delineators are always visible to the driver.

E. Lighting Devices

6E-1 Function

Construction and maintenance activities often create conditions on or near the traveled way that are particularly hazardous at night when drivers' visibility is sharply reduced. It is often desirable and necessary to supplement the reflectorized signs, barriers and channelizing devices with lighting devices that are described in the following paragraphs.

Three types of electric lights are commonly used: floodlights, steady-burning lights, and flashing lights.

6E-2 Floodlights

On construction projects, floodlights have a limited, but important application. Sometimes large construction contracts are prosecuted on a double shift basis, particularly earth moving activities. Oftentimes, the earth moving involves a haul road crossing a public highway, at which point a flagger station is generally set up. In order to assure the safest possible conditions at this type of location, it is advisable to supplement the warning devices (used in advance of the crossing) with floodlighting of the flagger station and the crossing site. Care is required in order to adequately illuminate the desired area without creating glare in the eyes of drivers on the highway. The adequacy of the floodlight placement can best be determined by driving through and observing the floodlighted area from each direction on the highway.

Maintenance activities on urban freeways, with high volume, high density traffic conditions, are frequently required to be conducted during nighttime periods (with low traffic volumes). Good floodlighting of the work site is a necessity because the workers need to see what they are doing and because the workers and the worksite need to be seen by passing drivers. The lighting units should be positioned so they do not cause glare to drivers on the highway.

6E-3 Hazard Identification Beacons (Flashing Electric Lights)

A Hazard Identification Beacon is a flashing yellow signal light (minimum diameter 8 inches) used at points of special hazard as a means of calling drivers' attention to these locations. When used, the flashing beacon should operate 24 hours a day.

On construction projects, because of the time and effort required to install and put these units into operation, they are used, generally, only at locations where frequent changes would not be required.

On projects where an existing dual highway is being upgraded to freeway standards (which requires the use of crossovers to permit stage construction) flashing beacons have been used effectively to call drivers' attention to the hazard created by the necessary channelizing devices. Similarly, the temporary terminus of a freeway (where all traffic is channelized into an exit) is a location where beacons have informed drivers of the speed reduction necessary in transitioning from freeway to local road operations.

Hazard Identification Beacons may be rated singly or in groups containing more than one unit.

During normal daytime maintenance operations, the functions of flashing beacons are adequately provided for by the lighting equipment on maintenance vehicles, either the emergency flashers, the rotating dome light, or both. However, at locations where the daytime maintenance activity requires an obstruction to remain in the roadway at night, flashing beacons may be installed at the point of hazard. At locations where vandalism is no problem, the power may be provided by a portable electric generator. (See sec. 4E-5)

6E-4 Steady-Burning Electric Lamps

As used herein, steady-burning electric lamps shall mean a series of low wattage yellow electric lamps. They may be used to mark obstructions or hazards, but they are generally less effective than flashing lights for these uses because of the attention getting effect of the latter. However, where lights are needed to delineate the traveled way through and around obstructions in a construction or maintenance area, the delineation shall be accomplished by use of steady-burning lamps.

Steady-burning lamps, placed in a line on longitudinal barricades, have been effective in delineating the proper vehicle path through stage construction areas (which require changing patterns of traffic movement).

The application of these devices during maintenance activities is infrequent due to the generally short time nature of maintenance work. A type of maintenance activity where steady-burning lamps could be utilized is the removal and replacement of a portion of a bridge deck. The lamps could be mounted on barricades and effectively aid in channelizing traffic around the work area.

6E-5 Warning Lights

As used herein, Warning Lights are portable, lens directed, enclosed lights. The color of the light emitted shall be yellow. They may be used in either a steady-burn or flashing mode. Warning lights shall be in accordance with the current ITE Purchase Specifications for Flashing and Steady-Burn Warning Lights. VI-18 (c) Rev. 3

Type A Low Intensity Flashing Warning lights are most commonly mounted on barricades, drums, vertical panels or advance warning signs and are intended to continually warn drivers that they are approaching or proceeding in a hazardous area.

Warning lights shall have a minimum mounting height of 36 inches to the bottom of the lens. Type B High Intensity Flashing Warning lights are normally mounted on the advance warning signs or on independent supports. Extremely hazardous site conditions within the construction area may require that the lights are effective in daylight as well as dark, they are designed to operate 24 hours per day.

Type C Steady-Burn lights are intended to be used to delineate the edge of the traveled way on detour curves, on lane changes, on lane closures and on other similar conditions. Their application shall be as indicated in section 6E-4.

The light weight and portability of warning lights are advantages that make these devices useful as supplements to the reflectorization on hazard warning devices. The flashing lights are effective in attracting a driver's attention and, therefore, provide an excellent means of identifying the hazard. Flashers shall not be used for delineation, as a series of flashers would tend to obscure the desired vehicle path.

Warning lights on barricades shall be installed to a minimum mounting height of 36 inches to the bottom of the lens.

Type A Low Intensity Flashing Warning Lights and Type C Steady Burn Warning Lights shall be maintained so as to be capable of being visible on a clear night from a distance of 3,000 feet. Type B High Intensity Flashing Warning Lights shall be maintained so as to be capable of being visible on a sunny day when viewed without the sun directly on or behind the device from a distance of 1,000 feet. VI-18 (c) Rev. 3

6E-6 Special Lighting Units

Special lighting units, generally trailer-mounted for easy transport to a jobsite, have been developed to supplement conventional signs, pavement markings and lighting for maintenance activities. The flashing lights on the unit are operated from a self-contained power source mounted on the trailer, either batteries or an electric generator. A variety of light configurations are used for traffic warning and guidance.

Most units are designed with racks, channels or other devices so that signs may be displayed with messages appropriate to the particular kind of work being performed.

These special lighting units are used most frequently on high density urban freeways and are placed just in advance of the worksite. The flashing lights, together with appropriate signs, have proven to be very effective warning devices while also providing some physical protection to the maintenance workers.

Although these special lighting units were developed to satisfy a need on urban freeways, they have many applications on all types of highways. Their mobility, together with the availability of flashing lights and/or a variety of sign messages makes them useful for almost any situation where conditions require extraordinary advance warning of the maintenance activities. If the units are to be used at night, consideration should be given to providing a means whereby the intensity of the flashers may be reduced during darkness when the lower intensities are desirable.

6E-7 Advance Warning Arrow Panel

Advance warning arrow panels are sign panels with a matrix of lights capable of either flashing or sequential displays. Advance Warning Arrow panels are intended to supplement other traffic control devices. Arrow panels will not solve difficult traffic problems by themselves, but they can be very effective when properly used to reinforce signs, barricades, cones, and other traffic control devices. Necessary signs, barricades, or other traffic control devices shall be used in conjunction with the advance warning arrow panel.

Arrow panels are effective in encouraging drivers to leave the closed lane sooner. Arrow panels provide additional advance warning and directional information where traffic must be shifted laterally along the roadway. They assist in diverting and controlling traffic around construction or maintenance activities being conducted on or adjacent to the traveled way and give drivers positive guidance about a roadway path diversion that they might not otherwise expect.

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Arrow panels are generally used for day or night lane closures, roadway diversions, and slow-moving maintenance and construction activities on the traveled way. They are particulary effective under high-speed and high-density traffic conditions. At night, they are effective where other traffic control devices cannot provide adequate advance warning of a roadway path diversion. During daylight, arrow panels are effective under high-density traffic conditions that might block the driver's advanced view of construction or maintenance activities ahead.

6E-8 Advance Warning Arrow Panel Application

Placement of arrow panel should be varied as needed to achieve the desired recognition distances. Also, care must be taken in the placement to avoid driver confusion in the vicinity of ramps, median crossovers, and side road intersections.

For stationary lane closures, the arrow panel should be placed on the shoulder at the beginning of the taper, or where there are narrow shoulders, in the closed lane behind the channelizing devices on the same side of the lane closure. Placement at the start of the taper is preferred to placement in the middle of the taper.

In diversions where arrow panel need has been determined, the arrow panel should be placed behind the barricades closing the roadway.

For moving-maintenance activities where a lane is closed, it is preferable that the arrow panel be placed at the rear of the activity in the closed lane on a vehicle separate from the maintenance vehicle itself. The arrow panel should always remain upstream of the maintenance vehicle where adequate recognition distance is available. The vehicle carrying the arrow panel should also be equipped with appropriate signing and/or lighting.

Generally arrow panels should not be used for shoulder or roadside work activities nor should they be used on two lane highways because the panels can cause unnecessary lane changing.

6E-9 Advance Warning Arrow Panel Specifications

Advance warning arrow panel shall meet the specifications of Table VI-3. The minimum legibility distance for various traffic conditions are based on the decision-sight distance concept. Minimum legibility distances are those at which the arrow panel message can be comprehended by a driver on a sunny day or clear night. Also shown are the arrow panel sizes needed to meet the legibility distance needs.

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Table VI-3

Advance Warning Arrow Panels

Type	*Minimum Size*	*Minimum Number of Panel Lamps*	*Minimum Legibility Distance*
A	24″ × 48″	12	½ mile
B	30″ × 60″	13	¾ mile
C	48″ × 96″	15	1 mile

Type A advance warning arrow panels are appropriate for use on low speed urban streets. Type B are appropriate for intermediate speed facilities and for maintenance or moving operations on high-speed roadways. Type C arrow panels are intended to be used on high-speed, high-volume construction projects.

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Arrow panels shall be rectangular, of solid construction, and finished with nonreflective flat black. The panels shall be mounted on vehicle, trailer, or other suitable support. Vehicle-mounted panels should be provided with remote controls. Minimum mounting height should be 7 feet above roadway to the bottom of the panel, except on vehicle mounted panels which should be as high as practicable.

Arrow panels should have the capability of the following mode selections: (1) left or right flashing or sequential arrows; or (2) left or right sequential chevrons; and (3) double flashing arrows; and (4) caution. The caution mode consists of four or more lamps, arranged in a pattern which will not indicate a direction.

Arrow panels shall be capable of a minimum of 50 percent dimming from their rated lamp voltage. The flashing rate of the lamps shall not be less than 25 nor more than 40 flashers per minute.

Minimum lamp "on time" shall be 50 percent for the flashing arrow and 25 percent for the sequential chevron.

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The arrow panel lamps or lenses shall be recess mounted or, alternately equipped with an upper hood of not less than 180°, and the color of the light emitted shall be yellow.

F. CONTROL OF TRAFFIC THROUGH WORKAREAS

6F-1 Function

The primary function of traffic control procedures is to move traffic safely and expeditiously through or around workareas.

The control of traffic through workareas is an essential part of highway construction and maintenance operations. For these operations there must be adequate legislative authority for the implementation and enforcement of needed traffic regulations, parking controls and speed zoning. Such statutes must provide sufficient flexibility in the application of traffic control to meet the needs of the changing conditions in workareas.

Maintaining good public relations is necessary. The cooperation of the various news media in publicizing the existence of and reasons for worksites, therefore can be of great assistance in keeping the motoring public well informed.

6F-2 Hand Signaling Devices

A number of hand signaling devices, such as STOP/SLOW paddles, lights and red flags are used in controlling traffic through work zones. The sign paddle bearing the clear messages STOP or SLOW provide motorists with more positive guidance than flags and should be the primary hand-signaling device. Flag use should be limited to emergency situations and at spot locations which can best be controlled by a single flagger.

Sign paddles should be at least 18 inches wide with letters at least 6 inches high. A rigid handle should be provided. This combination sign may be fabricated from sheet metal or other light semirigid material. The background of the STOP face shall be red with white letters and border. The background of the SLOW shall be orange with black letters and border. When used at night the STOP face shall be reflectorized red with white reflectorized letters and border, and the SLOW face shall be reflectorized orange and black letters and border. IV-20(c) Rev. 4

Flags used for signaling purposes shall be a minimum of 24 by 24 inches in size, made of good grade of red material securely fastened to a staff approximately 3 feet in length. The free edge should be weighted to insure that the flag will hang vertically, even in heavy winds.

6F-3 Flaggers

Since flaggers are responsible for human safety and make the greatest number of public contacts of all construction personnel, it is important that qualified personnel be selected. A flagger should possess the following minimum qualifications:

1. Average intelligence.
2. Good physical condition, including sight and hearing.
3. Mental alertness.
4. Courteous but firm manner.
5. Neat appearance.
6. Sense of responsibility for safety of public and crew.

The use of orange clothing such as a vest, shirt, or jacket shall be required for flaggers. For nighttime conditions similar outside garments shall be reflectorized.

Flaggers are provided at worksites to stop traffic intermittently as necessitated by work progress or to maintain continuous traffic past a worksite at reduced speeds to help protect the work crew. For both of these functions the flagger must, at all times, be clearly visible to approaching traffic for a distance sufficient to permit proper response by the motorist to the flagging instructions, and to permit traffic to reduce speed before entering the worksite. In positioning flaggers consideration must be given to maintaining color contrast between the work area background and the flagger's protective garments.

6F-4 Flagging Procedures

The following methods of signaling with sign paddles should be used:

1. To STOP Traffic. The flagger shall face traffic and extend the STOP sign paddle in a stationary position with the arm extended horizontally away from the body. The free arm is raised with the palm toward approaching traffic.

2. When it is Safe for Traffic to Proceed. The flagger shall face traffic with the SLOW sign paddle held in a stationary position with the arm extended horizontally away from the body. The flagger motions traffic ahead with the free hand.

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3. When it is Desired to Alert or Slow Traffic. The flagger shall face traffic with the SLOW sign paddle held in a stationary position with the arm extended horizontally away from the body.

The following methods of signaling with a flag should be used:

1. To Stop Traffic. The flagger shall face traffic and extend the flag horizontally across the traffic lane in a stationary position so that the full area of the flag is visible hanging below the staff. For greater emphasis, the free arm may be raised with the palm toward approaching traffic.

2. When it is Safe for Traffic to Proceed. The flagger shall stand parallel to the traffic movement, and with flag and arm lowered from view of the driver, motion traffic ahead with the free arm. Flags shall not be used to signal traffic to proceed.

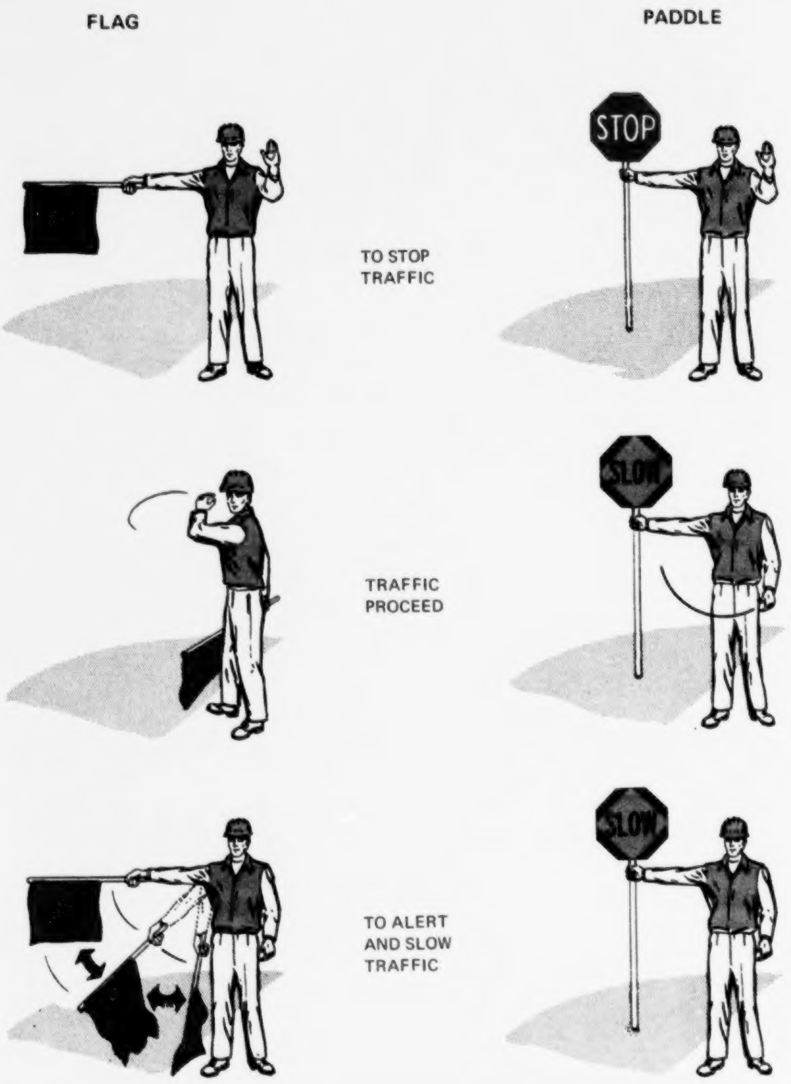
FLAG
PADDLE
STOP
TO STOP TRAFFIC
SLOW
TRAFFIC PROCEED
SLOW
TO ALERT AND SLOW TRAFFIC

Figure 6-15. Use of hand signaling devices by flagger.

3. Where it is Desired to Alert or Slow Traffic. Where it is desired to alert or slow traffic by means of flagging, the flagger shall face traffic and slowly wave the flag in a sweeping motion of the extended arm from the shoulder level to straight down without raising the arm above a horizontal position.

The use of the flag and sign paddle are illustrated in figure 6-15. VI-20(c) Rev. 4

Lights approved by the appropriate highway authority or reflectorized sign paddles or reflectorized flags shall be used to flag traffic at night. Daytime flagging procedures shall be followed whenever such lights, paddles or flags are used at night.

Whenever practicable, the flagger should advise the motorist of the reason for the delay and the approximate period that traffic will be halted. Flaggers and operators of construction machinery or trucks should be made to understand that every reasonable effort must be made to allow the driving public the right-of-way and prevent excessive delays.

6F-5 Flagger Stations

Flaggers stations shall be located far enough in advance of the worksite so that approaching traffic will have sufficient distance to reduce speed before entering the project. This distance is related to approach speed and physical conditions at the site; however 200 to 300 feet is desirable. In urban areas when speeds are low and streets closely spaced, the distance necessarily must be decreased.

The flagger should stand either on the shoulder adjacent to the traffic being controlled or in the barricaded lane. At a "spot" obstruction a position may have to be taken on the shoulder opposite the barricaded section to operate effectively. Under no circumstances should a flagger stand in the lane being used by moving traffic. The flagger should be clearly visible to approaching traffic at all times. For this reason the flagger should stand alone, never permitting a group of workers to congregate around the flagger station. The flagger should be stationed sufficiently in advance of the work force to warn them of approaching danger, such as out-of-control vehicles.

Flagger stations should be adequately protected and preceded by proper advance warning signs. At night, flagger stations should be adequately illuminated.

At short construction and maintenance lane closures where adequate sight distances is available for the safe handling of traffic the use of one flagger may be sufficient.

6F-6 One-Way Traffic Control

Where traffic in both directions must, for a limited distance, use a single lane, provision should be made for alternate one-way movement to pass traffic through the constricted section. At a "spot" obstruction, such as an isolated pavement patch, the movement may be self-regulating. However where the one-lane section is of any length, there should be some means of coordinating movements at each end so that vehicles are not simultaneously moving in opposite directions in the section and so that delays are not excessive at either end. Control points at each end of the route should be chosen so as to permit easy passing of opposing lines of vehicles.

Alternate one-way traffic control may be effected by the following means:

1. Flagger control.
2. Flag-carrying or official car.
3. Pilot car.
4. Traffic signals.

6F-7 Flagger Control

Where the one-lane section is short enough so that each end is visible from the other end, traffic may be controlled by means of a flagger at each end of the section. One of the two should be designated as the chief flagger for purposes of coordinating movement. They should be able to communicate with each other verbally or by means of signals. These signals should not be such as to be mistaken for flagging signals.

Where the end of a one-lane section is not visible from the other end, the flaggers may maintain contact by means of radio or field telephones. So that a flagger may know when to allow traffic to proceed into the section, the last vehicle from the opposite direction can be identified by description or license.

6F-8 Flag-Carrying or Official Car

Flag carrying is effective when the route is well defined and nonhazardous. It should be employed only when the one-way traffic is confined to a relatively short stretch of road, usually not more than 1 mile in length.

The driver of the last vehicle proceeding into the one-lane section is given a red flag (or other token) and instructed to deliver it to the flagger at the other end. The opposite flagger, upon receipt of the flag, then knows that it is safe to allow traffic to move in the other direction. The flag being carried should always be clean and dry.

A variation of this method is the use of an "official" car which always follows the last vehicle proceeding through the section. The use of an official car eliminates the possibility of loss of the flag.

6F-9 Pilot Car

The use of a pilot car for traffic control can be most effective where the route is particularly hazardous, or so involved or frequently altered as to preclude adequate signing. The pilot car is used to guide a train of vehicles through the job or detour. Its operation must be coordinated with flagging operations or other controls at each end of the one-lane section. Sufficient turnaround room should be provided at these points. Provision should be made for identification of the last vehicle in the column.

The vehicle selected for pilot-car study should be light weight and easy to handle and should have the name of the contractor or contracting authority prominently displayed. The Pilor Car sign (sec. 6B-39) shall be mounted on the rear of the vehicle.

Two or more pilot cars may be used to guide two-way traffic through a particularly complex or hazardous detour.

6F-10 Traffic Control Signals

Traffic control signals may be used for special applications to control vehicular traffic movements at construction or maintenance work areas.

Typical applications include:

1. A highway or street intersection with a temporary "haul road" or equipment crossing.

2. Through areas requiring one-way traffic operations.

All traffic signal and control equipment shall meet the applicable standards and specifications prescribed in Part IV of this Manual. Normally, these installations shall be operated by means of traffic actuation or manual control.

One-way traffic operation necessitates the use of an all-red interval of sufficient duration for traffic to clear the zone at the speed posted through the work areas.

G. EXPRESSWAYS AND LIMITED ACCESS FACILITIES

6G-1 Application of Standards

Serious problems of traffic control occur under the special conditions encountered where traffic must be moved through or around maintenance or construction operations on high-speed, high-volume facilities. Although the general principles outlined in the previous sections of the Manual are applicable to all types of highway facilities, special consideration must be given to the modern, high-speed and usually limited access-type of highway to accommodate traffic in a safe and efficient manner and for adequate protection of work forces. The density of traffic on these facilities requires that traffic control procedures be implemented, for example, to permit critical merging maneuvers to occur well in advance of workareas and in a manner which creates minimum turbulence in the traffic stream. These situations may require a much higher type of device than specified for normal rural or urban street use. The same important basic considerations of uniformity and standardization of general principles apply, however, for all facilities.

6G-2 Problem Areas

The conduct of maintenance and construction operations under high-speed, high-density traffic on controlled access highways is complicated by many of the design and operational features inherent in their use.

The presence of median dividers on many facilities which establish separate roadways for directional traffic also may prohibit the closing of that roadway for maintenance operations or the diverting of traffic to other lanes.

Lack of access to and from adjacent facilities prohibits rerouting of traffic away from work areas in many cases.

A major consideration in the establishment of traffic controls is the vehicular speed differential which exists and the limited time for drivers to safely react to unusual conditions.

In many cases, the year-round night and day intensity of use of expressways and limited-access facilities means that there is no season during which maintenance work can be scheduled when traffic volumes and density are low. Instead, these activities must be performed under extremely hazardous conditions.

Other conditions exist where work must be limited to night hours necessitating increased use of warning lights and illumination for work areas and advance warning systems.

The following sections emphasize some of the special considerations which must be applied in the application of devices for control of traffic, considering the above conditions.

6G-3 Signs

The messages of most of the standard warning signs described previously are applicable; however, signs larger than 48 × 48 inches may be desirable or required for additional emphasis. For large signs, a rectangular shape may be justified with approval of the appropriate highway authority. Movable signs mounted on trucks or trailers with specially constructed lighting units provide a means of giving additional advance warning to motorists. Requirements may exist for placing advance signs at ½, 1, or even 2 miles from the worksite to inform traffic of possible delays before they reach exits that might lead to alternate routes and where traffic might be expected to back up past conventional warning signs placed at the worksite. It is also desirable to place additional advance warning on adjacent facilities whenever entrances to the limited-access facility are past the usual warning signs.

A complete series of warning signs is generally required on both sides of the roadway for lane closures or other restrictions to traffic flow which may be encountered. The sign layout should provide the driver with specific information on the lane closed; for example, type of activity or event, speed controls, and special directions for passing around or through the worksite. The reasonableness of all restrictions must be carefully evaluated to obtain maximum driver observance.

All supports for signing should be installed with the breakaway or yielding features for motorists' safety.

A variety of information and guide signs may be needed on the approach to work sites for various purposes in addition to the hazard warning signs.

6G-4 Barricades and Channelization

The direction of freeway-type traffic through or around worksites requires the use of prominently positioned barricades and delineation devices for establishing tapers for lane closures or other situations where traffic must divert from its normal path. The success or failure of a lane closure will often depend upon the ability of traffic in a closed lane to merge with the adjacent lane. In practice this merge does not usually take place until the taper barricades, cones or other devices are encountered. For this reason the taper length must be sufficiently long to give drivers every opportunity to find an acceptable gap in the adjacent lane before having to slow down or stop and impede other traffic. Under relatively normal conditions of speed and volume, and where adequate warning of a lane obstruction has been provided, the taper rate described in section

6C-2 should be sufficient. However, this length should be adjusted as required by traffic operations.

Because of space and other limitations, cones may have greater use than barricades for transition sections. For night use, illumination may be required in addition to reflectorization of all devices in the transition section.

6G-5 Lighting Devices

The general principles used for daytime freeway traffic controls are equally applicable at night. However, the need for adequate lighting devices is essential on high-speed facilities to maintain safe traffic flow. The addition of flashing lights to all advance warning signs and the complete illumination of night work areas should be considered.

6G-6 Control of Traffic

On freeway-type facilities, the objective of traffic control in maintenance and construction areas is to allow a free flow of traffic by keeping the maximum number of lanes open to traffic at all times. The use of traffic control signs should be discouraged. Additional police patrols and officers assigned to the worksite to keep traffic flowing will minimize delays. During peak hour condtions or when congestion develops, it may be necessary to delay work progress until traffic is moving freely. An emergency traffic operation plan should be developed for alternate routing of traffic in the event of a complete closure of one or more segments of the highway. Predetermined routes should be employed to divert excess traffic around the obstructions by intercepting traffic at some earlier point on the roadway. A specially equipped traffic control vehicle housing a complete set of traffic control signs and devices as well as vehicle-mounted signs and lights should be available, as required.

Invaluable assistance to the traffic control on major facilities can be provided through advance use of the public information media. Radio and television announcements, newspaper notices, road condition reports and maps and ramp hand-outs can be effectively utilized to inform the public of anticipated delays or congestion resulting from necessary maintenance and construction activities.

These practices should complement the on-site traffic control procedures and the preplanning which is essential for effective operations.

Personnel used for work on controlled-access facilities should receive formal training in traffic control, in the conduct of work at these locations and in the importance of keeping traffic moving through and around maintenance and construction sites.

Part VII. TRAFFIC CONTROLS FOR SCHOOL AREAS

A. GENERAL

7A-1 Need for Standards

Traffic control in school areas is a highly sensitive subject. If all the demands of parents and others were met, there would have to be many more police and adult guards for school duty; and many more traffic signals, signs, and markings. Such demands, however, are not always in line with actual needs.

Analyses often show that at many locations, school crossing controls requested by parents, teachers and other citizens are unnecessary and costly and tend to lessen the respect for controls that are warranted. It is therefore important to stress the point that regardless of the school location, safe and effective traffic control can best be obtained through the uniform application of realistic policies, practices and standards developed through engineering studies.

Pedestrian safety depends in large measure upon public understanding of accepted methods for efficient traffic control. This principle is never more important than in the control of pedestrians and vehicles in the vicinity of schools. Neither school children nor vehicle operators can be expected to move safely in school zones unless they understand both the need for traffic controls and the ways in which these controls function for their benefit.

Non-uniform procedures and devices cause confusion among pedestrians and vehicle operators, prompt wrong decisions, and can contribute to accidents. In order to achieve uniformity of traffic control in school areas, comparable traffic situations must be treated in the same manner. Each traffic control device and control method described in this part fulfills a specific function related to specific traffic conditions.

The type of school area traffic control used, either warning or regulatory, must be related to the volume and speed of traffic, street width and the number of children crossing. For this reason, the traffic controls necessary in a school area located on a major highway would not be needed on a residential street away from heavy traffic. Yet, the important point to be made is that a uniform approach to school area traffic controls must be developed to assure the use of similar controls for similar situations (which promotes uniform behavior on the part of vehicle operators and pedestrians).

A school route plan for each school serving elementary and kindergarten students is useful in developing uniformity in the use of school area traffic controls. The plan, developed by the school and traffic officials responsible for school pedestrian safety, consists of a simple map showing streets, the school, existing traffic controls, established school routes, and established school crossings. A typical school plan map is shown in figure 7-1.

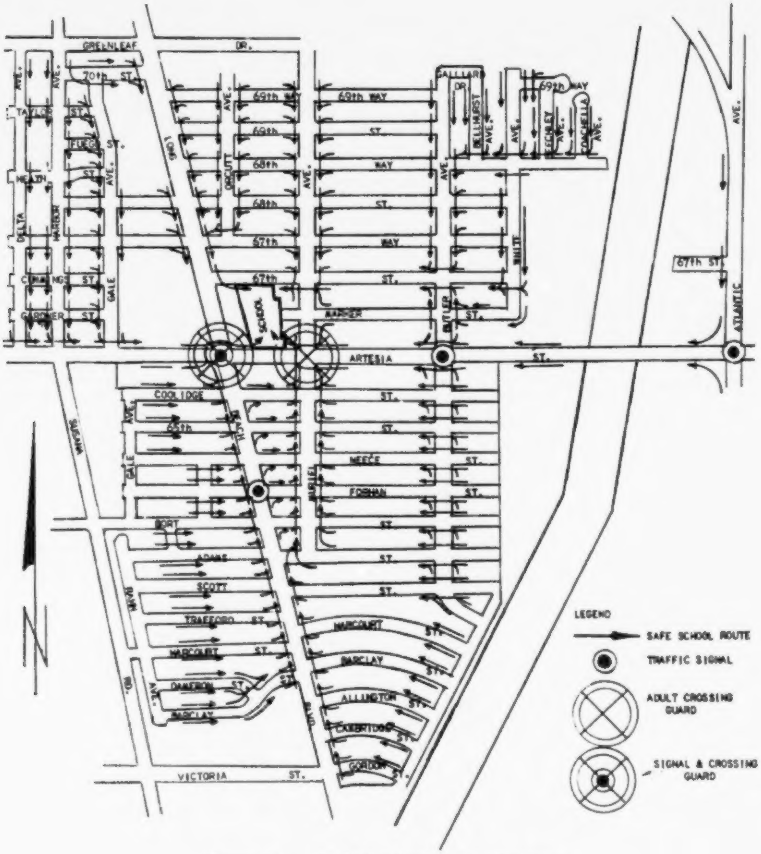
GREENLEAF
DR.
70th ST.
TAYLOR
ST.
FUEGO
HEATH
DELTA
HARBOR
AVE.
GALE
CUMMINGS ST.
GARDNER ST.
LONG
ORCUTT
69th WAY
69th
68th
67th
ST.
WAY
BELLHURST
BENCHLEY
CACHELLA
69th WAY
BUTLER
WHITE
67th ST.
ATLANTIC
SCHOOL
HARDER
ARTESIA
ST.
COOLIDGE
65th
BEACH
NEECE
FORMAN
MURIEL
SUSANA
PORT
ADAMS
SCOTT
TRAFFORD ST.
HARCOURT ST.
CAMERON ST.
BARCLAY
HARCOURT
BARCLAY
ALLINGTON
CAMBRIDGE
GORDON
VICTORIA ST.
LEGEND
SAFE SCHOOL ROUTE
TRAFFIC SIGNAL
ADULT CROSSING GUARD
SIGNAL & CROSSING GUARD
N

Figure 7-1. Typical school route plan map.

The plan permits the orderly review of school area traffic control needs, and the coordination of school pedestrian safety education and engineering activities.

The following treatment of signs, signals, and markings for school areas is intended to provide in effect a comprehensive handbook in its field, to be applied as a national standard. It establishes general principles to be observed in designing, installing, and maintaining traffic control devices in school areas, and prescribes specific standards where possible. While it constitutes a part of this Manual, it is designed so that it can be used independently, for the convenience of those who are not concerned with the many other phases of traffic control. To that end some material concerning specifications and devices having more general application is repeated here from preceding parts of this Manual.

Reference to reduced speed signs for school areas and crossings is included in this Manual solely for the purpose of standardizing signing for these zones. However, this is not to be considered an endorsement of the practice of mandatory reduced speed zones for all school areas and crossings.

7A-2 School Routes and Established School Crossings

School routes should be planned to take advantage of the protection afforded by existing traffic controls. This planning criterion may make it necessary for children to walk a non-direct, longer distance to an established school crossing located where there is existing traffic control, and to avoid the use of a direct, hazardous crossing where there is no existing traffic control.

Factors to be considered when determining the feasibility of requiring children to walk a longer distance to a crossing (at a location with existing traffic control) are:

1. The availability of adequate, safe sidewalks or off roadway sidewalk areas to and from the location with existing control,
2. The number of children using the crossing,
3. The age levels of the children using the crossing, and
4. The total extra walking distance.

7A-3 School Crossing Control Criteria

Alternate gaps and blockades are formed in the vehicular traffic stream in a pattern peculiar to each crossing location. For safety, a pedestrian must wait for a gap in traffic that is of sufficient duration to permit a street crossing without interference from vehicular traffic. When the delay between the occurrence of adequate gaps becomes excessive, children may become impatient and endanger themselves by attempting to cross the street during an inadequate gap. This delay may be considered excessive when the number of adequate gaps in the traffic stream, during the period the children are using a crossing, is less than the number of minutes in that same time period. With this condition (when adequate gaps occur less frequently than an average of one per minute) some form of traffic control is needed which will create in the traffic stream the gaps necessary to reduce the hazard.

A recommended practice for determining the frequency and adequacy of gaps in the vehicular traffic stream is given in the Institute of Transportation Engineers publication, A Program for School Crossing Protection. *

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* Available from Institute of Transportation Engineers, see page iv.

7A-4 Scope

This part sets forth basic principles and prescribes standards to be followed in the design, application, installation and maintenance of all traffic control devices and other controls required for the special pedestrian conditions of school areas. Such devices and controls include signs, signals, markings, adult guards, student patrols, and grade separated crossings.

7A-5 Application of Standards

The standards of this Manual apply to all streets and highways open to public travel regardless of type or the level of governmental agency having jurisdiction.

All traffic control devices used in school areas shall conform to the applicable specifications of this Manual.

7A-6 Engineering Study Required

The decision to use a particular device at a particular location should be made on the basis of an engineering study of the location. Thus, while this Manual provides standards for design and application of traffic control devices, the Manual is not meant to be a substitute for engineering judgment. It is the intent that the provisions of this Manual define the standards for traffic control devices, but shall not be a legal requirement for their installation.

7A-7 Maintenance of Traffic Control Devices

Maintenance of devices must be of high standards to assure that legibility is retained, that the device is visible, that it is functioning properly, and that it is removed if no longer needed.

Devices which are used on a part-time basis shall be in operation only during the time periods they are required.

Regulatory traffic control devices for school areas should be removed, covered or not operated when they are not needed for extended periods of time, such as during summer vacations.

7A-8 Placement Authority. (Refer to Section 1A-3.1.)

7A-9 Removal of Confusing Advertising

There should be legal authority to prohibit the display of any unauthorized sign, signal, marking, or device which interferes with the effectiveness of any official traffic control device. The enactment of Section 11-205 of the Uniform Vehicle Code will provide this authority.

7A-10 Meaning of "Shall," "Should" and "May"

In the Manual sections dealing with the design and application of traffic control devices, the words "shall," "should" and "may" are used to describe specific conditions concerning these devices. To clarify the meanings intended in this Manual in the use of these words, the following definitions are given:

1. SHALL—A mandatory condition. Where certain requirements in the design or application of the device are described with the "shall" stipulation, it is mandatory that these requirements be met.

2. SHOULD—An advisory condition. Where the word "should" is used, it is considered to be advisable usage, recommended but not mandatory.

3. MAY—A permissive condition. No requirement for design or application is intended.

B. SIGNS

7B-1 Design of Signs

Uniformity in design includes shape, color, dimensions, symbols, wording, lettering, and illumination or reflectorization. The Federal Highway Administration*, on request, will furnish to State and local highway and traffic authorities, sign manufacturers, and similarly interested agencies, detailed drawings of the standard signs illustrated in this Manual. Standardization of these signs does not preclude further improvement by minor changes in the proportion of symbols, stroke width, and height of letters, or width of borders. However, all shapes and colors shall be as indicated, all symbols shall be unmistakably similar to those shown and, where a word message is applicable, the wording shall be as provided herein.

Sometimes a change from word message to symbol requires a significant time period for public education and transition. For this purpose, educational plaques are provided for use beneath new symbol signs.

All symbol signs which are readily recognizable by the public may be erected without educational plaques. New warning or regulatory symbol signs not readily recognizable by the public, shall be accompanied by an educational plaque which is to remain in place for at least 3 years after initial installation. No special effort need be made to remove educational plaques as long as they are in serviceable condition.

Illustrations which accompany the text show the specifications for individual sign size, color, and legend. These specifications may not be detailed in the text.

7B-2 Dimensions

The sign dimensions prescribed in this Manual shall be standard for application on public highways. An increase above these standard sizes is desirable where greater legibility or emphasis is needed.

7B-3 Lettering

Sign lettering shall be in upper-case letters in conformance with the Standard Alphabets for Highway Signs Booklet.**

7B-4 Sign Borders

All signs illustrated herein have a border of the same color as the legend, at or just inside the edge. When a border is darker than the background, it should be set in from the edge. When the border is lighter, it should extend to the edge of the plate.

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* Available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590.

** Available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590.

7B-5 Illumination and Reflectorization

Ordinarily the signs used for school area traffic control shall be reflectorized or illuminated when regularly scheduled classes begin or end during hours of darkness, and should be reflectorized or illuminated when there is a considerable use of school buildings by children during hours of darkness.

7B-6 Position of Signs

Signs should be placed in positions where they will convey their messages most effectively without restricting lateral clearance or sight distances. Placement therefore should be accommodated to highway design, alignment and roadside development. Signs should have a maximum practical lateral clearance from the edge of the traveled way for safety of vehicles that may leave the roadway and strike the sign supports. Normally signs should not be closer than 6 feet from the edge of a paved shoulder, or if none, 12 feet from the edge of the traveled way.

In urban areas, if the lateral clearances indicated in the preceding paragraph are not practicable, a lesser clearance may be used (not less than 2 feet from the face of a curb). In urban areas, where sidewalk width is limited or existing poles are close to the curb, a clearance of 1 foot from the curb face is permissible.

Portable schools signs shall not be placed within the roadway at any time.

7B-7 Height of Signs

Signs erected at the side of the road in rural districts shall be mounted at a height of at least 5 feet, measured from the bottom of the sign to the level of the roadway edge. In business, commercial and residential districts where parking or pedestrian movement is likely to occur or where there are other obstructions to view, the clearance to the bottom of the sign shall be at least 7 feet.

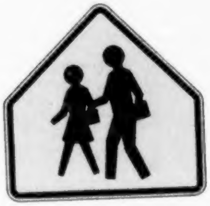
7B-8 Erection of Signs

Normally signs should be mounted approximately at right angles to the direction of, and facing, the traffic that they are intended to serve.

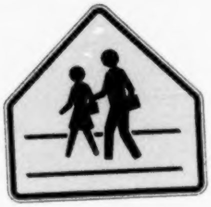
7B-9 School Advance Sign (S1-1)

The School Advance sign is intended for use in advance of locations where school buildings or grounds are adjacent to the highway. It may also be used in advance of established school crossings not adjacent to a school ground. The School Advance sign shall be used in advance of any installation of the S2-1 School Crossing sign.

Where used, the sign generally shall be erected not less than 150 feet nor more than 700 feet in advance of the school grounds or school crossing. The sign shall have a minimum height and width of 36 inches in rural areas, and 30 inches in urban areas.



S1–1
36" x 36"



S2–1
36" x 36"

7B–10 School Crossing Sign (S2–1)

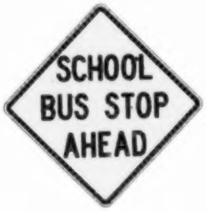
The School Crossing sign is intended for use at established crossings including signalized locations used by pupils going to and from school, except that at crossings controlled by stop signs, the sign should be omitted. Only crossings adjacent to schools and those on established school pedestrian routes shall be signed. When used, the sign shall be erected at the crosswalk, or at the minimum distance possible in advance of the crosswalk. The sign shall have a minimum height and width of 36 inches in rural areas, and 30 inches in urban areas.

A School Advance sign (sec. 7B–9) shall be used in advance of every School Crossing sign.

7B–11 School Bus Stop Ahead Sign (S3–1)

The School Bus Stop Ahead sign is intended for use in advance of locations where a school bus, when stopped to pick up or discharge passengers, is not visible for a distance of 500 feet in advance. It shall have a minimum 30" x 30" size.

It is not intended that these signs be used everywhere a school bus stops to pick up or discharge passengers but for use only where terrain and roadway features limit the approach sight distance and where there is no opportunity to relocate the stop to another location with adequate visibility.



S3–1
30" x 30"

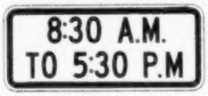
7B-12 School Speed Limit Signs (S4-1, S4-2, S4-3, S4-4)

The School Speed Limit sign shall be used to indicate the speed limit where a reduced speed zone for a school area has been established (in accordance with law, after an engineering and traffic investigation) or when a speed limit is specified for such areas by statute. The sign shall be either a fixed-message sign assembly or a variable display type sign.

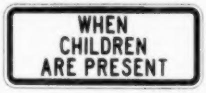
The fixed message sign assembly shall consist of a top panel (S4-3), 24″ x 8″ (the legend SCHOOL in black on a yellow background), a Speed Limit sign (R2-1), 24″ x 30″, and a bottom panel (S4-1) indicating the specific periods of the day and/or days of the week, when the special school speed limit applies. The bottom panel shall be 24″ x 10″ (or larger if needed) and shall have a black legend on a white background. Alternate legends such as WHEN CHILDREN ARE PRESENT (S4-2) may be used if permitted by law. The numerical speed limit displayed on the sign shall be the limit established by law.

Variable display signs may be used to indicate the special school speed limit. These signs may use blank-out messages or other methods to display the school speed limit only during the periods it applies. A Speed Limit Sign Beacon (sec. 7D-24) may also be used, with a WHEN FLASHING sign (S4-4), to identify the periods the school speed limit is in force. The lenses of the Speed Limit Sign Beacon may be positioned within the face of the School Speed Limit sign.

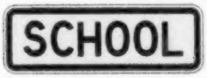
Because of special features, it may not always be practical to make variable display signs conform in all respects to the accepted standards. However, during the periods the school speed limit is in force, their basic shape, message, legend layout, and colors should conform to the standard for the fixed message sign, except that if the sign is internally illuminated, it may have a white legend on a black background.



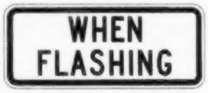
S4-1
24″ x 10″



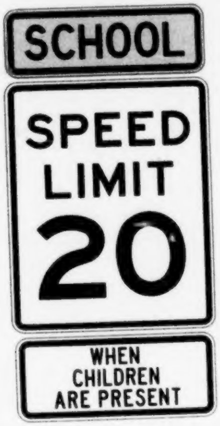
S4-2
24″ x 10″



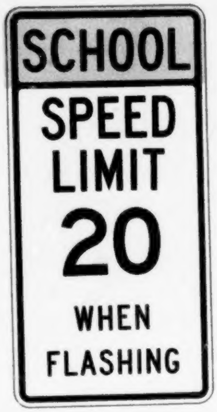
S4-3
24″ x 8″



S4-4
24″ x 10″



School Speed Limit
Sign Assembly



Possible Sign
With Speed Limit
Sign Beacon

Variable display signs with flashing beacons should be used for the more critical situations, where greater emphasis of the special school speed limit is needed.

Where practical, consideration should be given to including, on the back of variable display signs, a light or device to indicate the speed limit message is in operation or visible.

The end of an authorized and posted school speed zone shall be marked with a standard Speed Limit sign showing the speed limit for the section of highway which follows or with an END SCHOOL ZONE sign. II-45 (c) Rev. 3

7B-13 Parking and Stopping Signs (R7 Series)

Parking signs and other signs governing the stopping and standing of vehicles in school areas cover a very wide variety of regulations and only general specifications can be laid down here. Typical examples are as follows:

1. No Parking 8:00 AM to 5:00 PM School Days Only.
2. No Stopping 8:00 AM to 5:00 PM School Days Only.
3. 5 Min. Loading 8:00 AM to 5:00 PM School Days Only.

The legend on parking signs shall state whatever regulations apply, but the signs shall conform to the standards of shape, color, position and use. Generally, parking signs should display such of the following information as is appropriate, from top to bottom of the sign, in the order listed:

1. Restriction or prohibition.
2. Time of day it is applicable, if not at all hours.
3. Days of week applicable, if not every day.

In addition, there should be a singled-headed arrow pointing in the direction the regulation is in effect (if the sign is at the end of a zone) or a double-headed arrow pointing both ways (if the sign is at an intermediate point in the zone). As an alternate to the arrow (if the signs are posted facing traffic at an angle of 90 degrees to the curb line) there may be included on the sign, or on a separate plate below the sign, such legend as BEGIN, END, HERE TO CORNER, HERE TO ALLEY, THIS SIDE OF SIGN, or BETWEEN SIGNS.

Where parking is prohibited at all times or at specified times, parking signs shall have red letters and border on a white background (Parking Prohibition signs); and where only limited-time parking is permitted, or where parking is permitted only in a particular manner, the signs shall have green letters and border (Parking Restriction signs).

For emphasis the word NO or the numeral showing the time limit in hours or minutes may be in a reversed color arrangement in the upper left-hand corner of the sign, i.e., in white on a rectangular area of red or green.

The No Parking symbol (shown in sign R8-3a) may be used as an alternative to the words NO PARKING on signs R7-1, R7-2, R7-3, R7-6, R7-7, and R7-107a. When the symbol sign itself (R8-3a) is used for urban applications, it shall have a minimum and standard size of 12 inches square. The symbol "P" is black, circumscribed in a red circle with a red slash on a white background and black border.

The supplemental educational plaque, NO PARKING, with a red legend and border on a white background, may be used above the symbol.

Parking signs shall have a standard size of 12 inches by 18 inches. If arrows are used to indicate the extent of the restricted zone, the signs should be set at an angle of not less than 30 degrees nor more than 45 degrees with the line of traffic flow to be visible to approaching traffic. If word legends on a separate panel are used to indicate the extent of the restricted zone, the signs should be posted facing traffic at an angle of 90 degrees to the curb line.

C. MARKINGS

7C-1 Functions and Limitations of Markings

Markings have definite and important functions to perform in a proper scheme of school area traffic control. In some cases they are used to supplement the regulations or warnings of other devices such as traffic signs. In other instances they obtain results, solely on their own merits, that cannot be obtained by the use of any other device. In such cases they serve as a very effective means of conveying certain regulations and warnings that could not otherwise be made clearly understandable.

Pavement markings have definite limitations. They are obliterated by snow, may be clearly visible when wet, and may not be very durable when subjected to heavy traffic. In spite of these limitations, they have the advantage, under favorable conditions, of conveying warnings or information to the driver without diverting his attention from the roadway.

7C-2 Standardization

Each standard marking shall be used only to convey the meaning prescribed for it in this Manual.

7C-3 Crosswalk Lines

Crosswalk lines shall be solid white lines marking both edges of the crosswalk. They shall be not less than 6 inches in width and should not be spaced less than 6 feet apart. Under special curcumstances (where no advance stop line is provided or where vehicular speeds exceed 35 MPH or where crosswalks are unexpected) it may be desirable to increase the width of the crosswalk line up to 24" in width. Crosswalk lines on both sides of the crosswalk should extend across the full width of pavement to discourage diagonal walking between crosswalks.

Crosswalks should be marked at all intersections on established routes to school where there is material conflict between vehicles and kindergarten or elementary students (while crossing), where students are permitted to cross between intersections, or where students could not otherwise recognize the proper place to cross.

For added visibility, the area of the crosswalk may be marked with white diagonal lines at a 45° angle or with white longitudinal lines at a 90° angle to the line of the crosswalk. These lines should be approximately 12" to 24" wide and spaced 12" to 24" apart. When diagonal or longitudinal lines are used to mark a crosswalk, the transverse crosswalk lines may be omitted. Care should be taken to insure that crosswalks with diagonal or longitudinal lines used at some locations do not weaken or detract from other crosswalks where special emphasis markings are not used.

7C-4 Stop Lines

Stop lines are solid white lines, normally 12 to 24 inches wide, extending across all approach lanes, and (under both urban and rural conditions) indicate the point at which vehicles are required to stop in compliance with a stop sign, traffic signal, officer's direction, or other legal requirement. When used, the stop line should ordinarily be placed 4 feet in advance of and parallel to the nearest crosswalk line.

7C-5 Curb Markings for Parking Restrictions

Since curb markings of yellow and white are used for delineation and visibility, it is usually advisable to establish parking regulations through the installation of standard signs. However, when local authorities prescribe special colors for curb markings as supplemental to standard signs, they may be used.

When signs are not used, intended meaning should be stenciled on the curb.

Signs shall always be used with curb markings in those areas where curb markings are frequently obliterated by accumulations of snow and ice.

7C-6 Word and Symbol Markings

Word and symbol markings on the pavement may be used for the purpose of guiding, warning, or regulating traffic. They should be limited to not more than a total of three lines of words and/or symbols. They shall be white in color.

Word and symbol markings shall not be used for mandatory messages except in support of standard signs.

The letters, numerals, and symbols should be in accordance with the Standard Alphabets and Symbols for Highway Pavement Markings. * Letters and numerals should be 8 feet or more in height; and, if the message consists of more than one word, it should read "up" i.e., the first word should be nearest to the driver. Where approach speeds are low, somewhat smaller characters may be used. The space between lines should be at least four times the height of the characters for low speed roads but not more than ten times the height of the characters under any conditions. Figure 7-2 shows the word SCHOOL in typical, elongated, pavement marking letters.

Pavement messages should preferably be no more than one lane in width except SCHOOL messages may extend to the width of two lanes. When a two-lane width is used the characters should be 10 feet or more in height.

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* Available from the Federal Highway Administration (HTO-20), Washington, D.C. 20590.

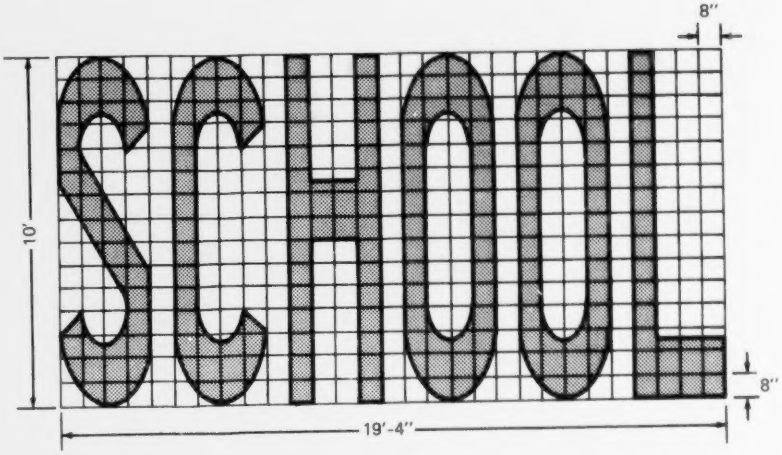

Figure 7-2. Two-lane pavement marking—detail of word "SCHOOL".

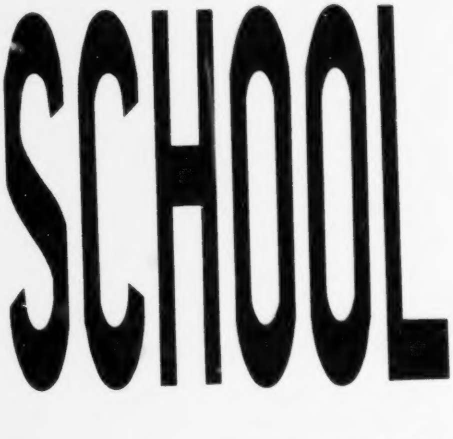

Figure 7-3. Single-lane pavement marking—"SCHOOL".

D. SCHOOL AREA TRAFFIC SIGNALS

7D-1 Definition

School signals are standard traffic control signals erected at established school crossings on the basis of a need to create adequate gaps in the vehicular traffic stream for pedestrian crossings.

7D-2 Advantages and Disadvantages

When properly designed, located and operated under conditions that fully warrant their use, school signals usually have either or both of the following advantages:

1. Considering initial and operating costs, school signals over a period of several years represent an economy as compared with police supervision or crossing guards.
2. Under conditions of favorable spacing they can be coordinated with adjacent signals to provide for continuous or nearly continuous movement of vehicular traffic.

Properly designed and warranted signals also have some disadvantages and the following should be considered when choosing a specific means of crossing control:

1. School signal control has a much higher initial cost than police supervision or crossing guards. It should not be considered for locations where several years use cannot be expected.
2. In some circumstances, the school signal control requires supplemental control by an adult guard or school safety patrol.
3. If school signal control is to be properly operated, provision must be made for both periodic and emergency maintenance by capable, trained persons.

7D-3 Standardization

Because of the great mobility of today's traffic and the ever-increasing range of traffic circulation, it is of primary importance that there be national standardization of those features of traffic signals that affect public participation in traffic movement. This applies without exception to signals at school crossings, where instant recognition and understanding of controls is vital to both students and motorists. Deviations and innovations in school areas, however well-accepted by local people, are bound to lead to confusion and disobedience on the part of strangers.

Design, application, location, and operation lend themselves to a certain degree of standardization, and standards for such features are prescribed herein. A driver or pedestrian must first see signals and then react to their indications. Location and sequence of operation are basic requirements. Signals should be placed where a driver or pedestrian cannot miss seeing them. Standard signal indications and sequences should be used universally so that a signal message can be recognized and heeded at a glance.

7D-4 Warrants

A school signal may be warranted at an established school crossing when a traffic engineering study (of pedestrian group size and available gaps in the vehicular traffic stream) indicates that the number of adequate gaps in the traffic stream during the period the children are using the crossing, is less than the number of minutes in that same time period (sec. 7A-3).

When traffic control signals are installed solely under this warrant:

1. Pedestrian signal indications shall be provided at least for each crosswalk established as a school crossing.

2. At an intersection, the signal normally should be traffic actuated (sec. 7D-7). Intersection installations that can be fitted into progressive systems may use pretimed control.

3. At non-intersection crossings, the signal should be pedestrian actuated, parking and other obstructions to view should be prohibited for at least 100 feet in advance of and 20 feet beyond the crosswalk, and the installation should include suitable standard signs and pavement markings. Special police supervision and/or enforcement should be provided for a new non-intersection location.

A School Advance sign (sec. 7B-9) and a School Crossing sign (sec. 7B-10) may be used at locations where signals are installed under this warrant.

7D-5 Meaning of Signal Indications

In Part IV of this Manual meanings and applications for all traffic signal color and arrow indications are given. In this section the meanings are given only for the signal indications generally used at school crossings and the flashing yellow when a speed limit sign beacon is used as part of a variable display School Speed Limit sign assembly (sec. 7B-12).

The CIRCULAR GREEN indication and the GREEN ARROW indication shall have the following meanings: *

1. Traffic, except pedestrians, facing a CIRCULAR GREEN signal may proceed straight through or turn right or left unless a sign at such place prohibits either such turn. But vehicular traffic, including vehicles turning right or left, shall yield the right-of-way to other vehicles and to pedestrians lawfully within the intersection or an adjacent crosswalk at the time such signal is exhibited.

2. Traffic, except pedestrians, facing a GREEN ARROW signal, shown alone or in combination with another indication, may cautiously enter the intersection only to make the movement indicated by such arrow, or such other movement as is permitted by other indications shown at the same time. Such vehicular traffic shall yield the right-of-way to pedestrians

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* Section 11-202, Uniform Vehicle Code, Revised 1968.

lawfully within an adjacent crosswalk and to other traffic lawfully using the intersection.

3. Unless otherwise directed by a pedestrian signal, pedestrians facing any green signal, except when the sole green signal is a turn arrow, may proceed across the roadway within any marked or unmarked crosswalk.

The steady CIRCULAR YELLOW and YELLOW ARROW shall have the following meanings.*

1. Traffic, except pedestrians, facing a steady CIRCULAR YELLOW or YELLOW ARROW signal is thereby warned that the related green movement is being terminated or that a red indication will be exhibited immediately thereafter when vehicular traffic shall not enter the intersection.

2. Pedestrians facing a steady CIRCULAR YELLOW or YELLOW ARROW signal, unless otherwise directed by a pedestrian signal, are thereby advised that there is insufficient time to cross the roadway before a red indication is shown and no pedestrian shall then start to cross the roadway.

The steady CIRCULAR RED or RED ARROW shall have the following meanings:**

1. Traffic, except pedestrians, facing a steady CIRCULAR RED signal alone shall stop at a clearly marked stop line, but if none, before entering the crosswalk on the near side of the intersection, or if none, then before entering the intersection and shall remain standing until an indication to proceed is shown except as provided in (3) below.

2. Vehicular traffic facing a steady RED ARROW signal shall not enter the intersection to make the movement indicated by the arrow and, unless entering the intersection to make a movement permitted by another signal, shall stop at a clearly marked stop line, but if none, before entering the crosswalk on the near side of the intersection, or if none, then before entering the intersection and shall remain standing until an indication permitting the movement indicated by such red arrow is shown except as provided in (3) below.

3. Except when a sign is in place prohibiting a turn, vehicular traffic facing any steady red signal may cautiously enter the intersection to turn right, or to turn left from a one-way street into a one-way street, after stopping as required by (1) and (2) above. Such vehicular traffic shall yield the right-of-way to pedestrians lawfully within an adjacent crosswalk and to other traffic lawfully using the intersection.

4. Unless otherwise directed by a pedestrian signal, pedestrians facing a steady CIRCULAR RED or RED ARROW signal alone shall not enter the roadway.

Pedestrian signal indications shall have the following meanings:

1. The DONT WALK indication, steadily illuminated, means that a pedestrian shall not enter the roadway in the direction of the indication.

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* Ibid.

** Ibid.

2. The DONT WALK indication, while flashing, means that a pedestrian shall not start to cross the roadway in the direction of the indication, but that any pedestrian who has partly completed his crossing during the steady WALK indication shall proceed to a sidewalk, or to a safety island.

3. A WALK indication, whether steady or flashing, means that pedestrians facing the signal indication may proceed across the roadway in the direction of the indication. In addition a WALK indication indicates one of the following:

(a) A steady WALK indication, when used in an area where the optional flashing WALK (see 3b below) is not used, indicates that there may or may not be possible conflicts of pedestrians with vehicles turning on a CIRCULAR GREEN indication.

(b) A flashing WALK (use optional) indication means that there is a possible conflict of pedestrians with vehicles turning on a CIRCULAR GREEN indication.

(c) A steady WALK indication when used in an area where the optional flashing WALK is used indicates the absence of conflicts of pedestrians with vehicles turning on CIRCULAR GREEN indication.

The flashing CIRCULAR YELLOW indication, displayed as a Speed Limit Sign Beacon, shall mean that the school speed limit shown on the sign is in effect.

7D-6 Intersection and Non-Intersection Installations

School signals may be installed at established school crossings at intersection and non-intersection locations under the adequate gap warrant.

Intersection locations have the hazards of turning vehicles and generally require the provision of signal equipment for the control of vehicle traffic on two streets. However, they are less likely to present an element of surprise for drivers, and they may provide a secondary function of improved vehicle access to an arterial street.

Non-intersection locations are free from the hazards of turning vehicles, require vehicle control equipment for one street only, and may offer added convenience to students. However, they can present an element of surprise for drivers who do not expect pedestrian crossings and signal control between intersections. Therefore, special attention should be given to the signal head placement and the signs and markings used at non-intersection locations, to be sure drivers are aware of this special application. Parking should not be allowed within 100 feet in advance of the crosswalk, nor 20 feet beyond.

7D-7 Controllers

School signals which are installed only under the adequate gap warrant (sec. 7D-4) shall be the traffic-actuated type unless an intersection installation is fitted into a progressive system and uses pre-timed control.

The traffic-actuated signal, as its name implies, responds to vehicle or pedestrian actuations, and it is necessary that detector and controller equipment be designed for this service. The general characteristics of the various types of detectors and controls that have been developed for use with traffic-actuated equipment are described in a supplemental publication.*

7D-8 Pedestrian Detectors

Detectors (usually push "buttons") for pedestrian-actuated signals should be conveniently located near each end of crosswalks where pedestrian actuation is required. A mounting height of 3½ to 4 feet above the sidewalk has been found best adapted to general usage. Permanent-type signs shall be mounted above or in unit with the detectors, explaining their purpose and use. At certain locations it may be desirable to supplement this sign with a larger sign suspended over the sidewalk to call attention to the push button. Where two crosswalks oriented in different directions, end at or near the same location, the positioning of pedestrian push buttons should clearly indicate which crosswalk signal is actuated by each push button. Additional push button detectors may be required on islands or medians where a pedestrian might become stranded.

Special purpose push buttons to be operated only by authorized persons should include a housing capable of being locked to prevent access by the general public. Instruction signs are not necessary in this case.

A pilot light or other means of indication may be installed with a pedestrian push button and normally shall not be illuminated. Upon actuation, it shall be illuminated until the pedestrian's green or WALK indication is displayed.

7D-9 Operation of Pedestrian Signals

At an intersection the four basic combinations of pedestrian signal intervals with vehicular signal operation are as follows:

1. Combined Pedestrian-Vehicular Interval—a signal phasing wherein pedestrians may proceed to use certain crosswalks and vehicles are permitted to turn across the said crosswalk (the pedestrian indication shall be flashing or steady WALK).

2. Exclusive Crosswalk Interval—a signal phasing wherein pedestrians may proceed to use certain crosswalks but vehicles are not permitted to move across these crosswalks during the pedestrian movement (the pedestrian indication shall be steady WALK).

3. Leading Pedestrian Interval—a signal phasing wherein an exclusive pedestrian interval, in advance of the vehicular interval, is provided for pedestrians (the pedestrian indication shall be steady WALK). When the leading pedestrian interval is terminated, and a combined pedestrian-vehicular interval begins, the WALK indication may begin to flash.

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* Traffic Control Devices Handbook, Federal Highway Administration (HTO-20), Washington, D.C. 20590.

4. All Pedestrian Phase—a signal phasing wherein pedestrians may proceed to cross the intersection in any direction during an exclusive phase while all vehicles are stopped (the pedestrian indication shall be steady WALK).

At non-intersection school signal installations, as there is no parallel vehicular movement, the pedestrian crossing is an exclusive interval.

Pedestrians should be assured of sufficient time to cross the roadway at a signalized intersection:

1. Where traffic signals are of the actuated type, control equipment should provide sufficient pedestrian crossing time when there has been a pedestrian actuation, whenever the minimum vehicular time is less than that needed by the pedestrians.

2. Where traffic signals are not of the vehicle-actuated type, pedestrian actuation may be used to provide sufficient pedestrian crossing time, or the vehicular time should be adjusted to provide the crossing time needed by pedestrians.

3. Under normal conditions, the WALK interval should be at least 4 to 7 seconds in length so that pedestrians will have adequate opportunity to leave the curb, before the clearance interval is shown. The lower values may be appropriate where it is desired to favor the length of an opposing phase and if pedestrian volumes and characteristics do not require the longer interval. The WALK interval itself need not equal or exceed the total crossing time calculated for the street width, as many pedestrians will complete their crossing during the flashing DONT WALK clearance interval.

4. A pedestrian clearance interval shall always be provided where pedestrian signal indications are used. It shall consist of a flashing DONT WALK indication. The duration should be sufficient to allow a pedestrian crossing in the crosswalk to leave the curb and travel to the center of the farthest traveled lane before opposing vehicles receive a green indication. (Normal walking speed is assumed to be 4 feet per second.) On a street with a median at least 6 feet in width, it may be desirable to allow only enough pedestrian clearance time on a given phase to clear the crossing from the curb to the median. In the latter case if the signals are pedestrian-actuated, an additional detector shall be provided on the island.

7D-10 Coordination with Adjacent Signals

A school signal at an established school crossing within half a mile of a signal controlling the same traffic should be coordinated with the adjacent signal.

Coordinated operation normally should include both pretimed signals and traffic-actuated signals within the appropriate distances.

7D-11 Vehicle Change Interval

A yellow vehicle change interval shall be used following each CIRCULAR GREEN interval and, where applicable, after each GREEN ARROW interval. In no case shall a CIRCULAR YELLOW indication be displayed in conjunction with the change from CIRCULAR RED to CIRCULAR GREEN.

The exclusive function of the yellow interval shall be to warn traffic of an impending change in the right-of-way assignment.

Yellow vehicle change intervals should have a range of approximately 3 to 6 seconds. Generally the longer intervals are appropriate to higher approach speeds.

7D-12 Location and Placement

The detailed standards and requirements governing the location and placement of all signals, including school signals, are given in Part IV of this Manual. The aspects of these standards and requirements most significant to school signals are given in the following sections.

7D-13 Visibility, Number, and Location of Signal Faces

Each signal face shall be so adjusted that its indications will be of maximum effectiveness to the approaching traffic for which they are intended.

Visors should be used on all signal faces to aid in directing the signal indication specifically to approaching traffic, as well as to reduce "sun phantom" resulting from external light entering the lens.

The visibility of signals shall be insured by providing, on each approach to an intersection, a minimum of two signal faces for through traffic. They should be continuously visible from the appropriate distances listed in Table VII-1, up to the stop line, unless a physical obstruction exists.

Table VII-1

85 Percentile Speed (mph)	*Minimum Visibility Distance (ft.)*
20	175
25	215
30	270
35	325
40	390
45	460
50	540
55	625
60	715

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Where physical conditions prevent drivers from having a continuous view of at least two signal indications as specified herein, a suitable sign shall be erected to warn approaching traffic. It may be supplemented by a Hazard Identification Beacon.

Unless physical conditions make it impractical, at least one, and preferably both of the signal faces as required above, shall be located not less than 40 feet nor more than 120 feet beyond the stop line. Such signal faces shall be located between two lines intersecting with the center of the approach lanes at the stop line, one making an angle of 20 degrees to the left of the centerline extended and the other making an angle of 20 degrees to the right of the centerline extended.

When overhead signals are required, the signal faces for any one approach shall not be less than eight feet apart, measured horizontally between centers of faces.

At signalized mid-block crosswalks, there should be at least one signal face over the traveled roadway for each approach. In other respects, a traffic control signal at a mid-block location shall meet the requirements set forth herein.

Pedestrian signal indications should be placed so they attract a pedestrian's attention and they should be readable from as far as the crossing width, to as close as 10 feet.

There shall be pedestrian signals located at each end of each established crosswalk.

The DONT WALK indication shall be mounted directly above or integral with the WALK indication.

Pedestrian indications may be mounted separately or on the same support with other signal heads. When mounted with other signal heads there shall be a physical separation between the two heads. The pedestrian signal head shall be so positioned and adjusted as to provide maximum visibility at the beginning of the controlled crossing.

The transverse location of a signal face mounted on the top of a post or on a short bracket from a post, shall conform to the requirements in section 7D-15.

7D-14 Height of Signal Faces

The bottom of the housing of a signal face not mounted over a roadway shall not be less than 8 feet or more than 15 feet above the sidewalk or, if none, above the pavement grade of the center of the highway, except that the bottom of center median, near side signal faces may be mounted at a minimum of 4 feet 6 inches above the median island grade.

The bottom of the housing of a signal face suspended over a roadway shall not be less than 15 feet or more than 19 feet above the pavement grade at the center of the roadway.

Within the above limits, optimum visibility and adequate clearance should be the guiding considerations in deciding signal height. Grades on approaching streets may be important factors, and should be considered in determining the most appropriate height.

Pedestrian signal faces shall be mounted with the bottom of the housing not less than 7 feet nor more than 10 feet above the sidewalk level, and so that there is a pedestrian indication in the line of vision of the pedestrian using the crosswalk to which it applies.

7D-15 Transverse Location of Traffic Signal Supports and Controller Cabinets

In the placement of traffic signal supports, primary consideration shall be given to ensuring the proper visibility of traffic signal faces as described in section 7D-13. However, in the interest of safety, traffic signal supports and controller cabinets should be placed as far as practicable from the edge of the traveled way without adversely affecting signal visibility.

Supports for post-mounted signals at the side of a street with curbs shall have a horizontal clearance of not less than two feet from the face of the curb. Where there is no curb, the support for a post-mounted signal shall have a clearance of not less than two feet from the shoulder within the limits of normal vertical clearance.

Signal supports should not obstruct a crosswalk.

No part of a concrete base for a signal support should extend more than 4 inches above the ground level at any point, except that this limitation does not apply to the concrete base for a rigid (non-breakaway) support.

On medians, the above minimum clearances for supports should be obtained where practicable. Any median supports which cannot be located with the required clearances should be of the breakaway type or should be guarded if at all practicable.

7D-16 Portable Traffic Control Signals

A portable traffic control signal must meet the physical display and operational requirements of conventional traffic signals described herein. A portable traffic control signal should normally not operate longer than 30 days unless associated with a construction or maintenance project, in which case it shall be removed when no longer needed on the project. It is desirable to use advance signing when employing this device. A portable traffic control signal should be used only when an engineering study so indicates.

7D-17 Area of Control

A traffic control signal shall control traffic only at the intersection or mid-block location where the installation is placed.

On a divided highway with a wide median, the crossing of each roadway may be signalized as a separate intersection.

7D-18 Design Requirements for School Signal Indications

The detailed standards and requirements governing the design of signal indications for all signals, including school signals, are given in Part IV of this Manual. The aspects of these standards and requirements most significant to school signals are given in the following sections.

7D-19 Number of Lenses per Signal Face

Each signal face, except in pedestrian signals, shall have at least three lenses, but not more than five. The lenses shall be red, yellow or green in color.

Each pedestrian signal face shall have two indications, white and orange as specified in section 7D-23.

7D-20 Size and Design of Signal Lenses

The aspect of all signal lenses, except in pedestrian signals, shall be circular. There shall be two sizes for lenses, 8 inches and 12 inches nominal diameter.

In no case shall letters or numbers be displayed on the visible part of vehicular signal indications.

All lenses shall conform to the Vehicle Traffic Control Signal Head Equipment Standards, 1985 Edition. *

7D-21 Arrangement of Lenses in Signal Faces

The lenses in a signal face shall be arranged in a vertical or horizontal straight line, except that in a vertical array lenses of the same color may be arranged horizontally adjacent to each other at right angles to the basic straight line arrangement. Such clusters shall be limited to two identical lenses or two or three different lenses of the same color.

In each signal face, all red lenses in vertical lenses signals shall be located above, and in horizontal signals shall be located to the left of all yellow and green lenses.

The circular yellow lens shall be located between the red lens or lenses and all other lenses.

7D-22 Illumination of Lenses in Vehicular Signal Faces

Each lens shall be illuminated independently. The intensity and distribution of light from each illuminated signal lens should meet the standards set forth in the following Institute of Transportation Engineers reports: Vehicle Traffic Control Signal Head Equipment Standards and a Standard for Traffic Signal Lamps. *

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7D-23 Pedestrian Indications

Pedestrian signal indications should attract the attention of and be readable to the pedestrian both day and night and at all distances from 10 feet to the full width of the area to be crossed.

All pedestrian indications shall be rectangular in shape and shall consist of the lettered or symbolized messages WALK and DONT WALK. Only internal illumination shall be used. Symbol designs are set forth in Standard Highway Signs.

When illuminated, the WALK indication shall be white, conforming to the current standard for Pedestrian Traffic Control Signal Indications, 1985 Edition,* with all except the letters or symbols obscured by an opaque material.

When illuminated, the DONT WALK indication shall be Portland orange, meeting the standards referred to above, with all except the letters or symbols obscured by an opaque material.

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* Available from the Institute of Transportation Engineers, see page iv.

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When illuminated, the WALK and DONT WALK messages shall not be readily distinguishable by pedestrians at the far end of the crosswalk they control.

For crossings where the distance from the near curb to the pedestrian signal indication is 60 feet or less, the letters, if used, shall be at least 3 inches high or the symbols, if used, shall be at least 6 inches high. For distances over 60 feet, the letters, if used, should be at least 4½ inches high and the symbols, if used, should be at least 9 inches high.

The light source shall be designed and constructed so that in case of an electrical or mechanical failure of the word DONT, the word WALK of the DONT WALK message will also remain dark.

7D-24 Speed Limit Sign Beacon

A Speed Limit Sign Beacon is two CIRCULAR YELLOW lens sections each having a visible diameter of not less than six inches, or alternately, one or more CIRCULAR YELLOW lenses, each having a visible diameter of not less than eight inches.

The yellow lens color shall be in accordance with the requirements of the Vehicle Traffic Control Signal Head Equipment Standards, Revised 1985.*

Where two lens sections are used, they shall be vertically aligned, except that they may be horizontally aligned if the speed sign is longer horizontally than vertically, and they shall be alternately flashed.

Speed Limit Sign Beacons shall be flashed at a rate of not less than 50 nor more than 60 times per minute. The illuminated period of each flash shall not be less than one-half and not more than two-thirds of the total cycle.

All flashing contacts should be equipped with a filter for suppression of radio interference.

When illuminated, the Speed Limit Sign Beacon shall be clearly visible to all drivers it faces for a distance of at least a quarter of a mile, under normal atmospheric conditions, unless otherwise physically obstructed.

A Speed Limit Sign Beacon is intended for use with a fixed or variable Speed Limit sign, to indicate that the speed limit shown is in effect. The lenses of a Speed Limit Beacon when used with a School Speed Limit Sign may be positioned within the face of the sign.

7D-25 School Crossings at Existing Signal Installations

Intersections where pre-timed or traffic-actuated signals have been installed on the basis of vehicle warrants (Part IV) may be convenient locations for established school crosswalks. If so, their use should be encouraged and proper allowance should be made in the signal equipment and operation for this use (secs. 7D-27 and 28).

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* Available from the Institute of Transportation Engineers, see page iv.

7D-26 Signal Indications

When an existing traffic signal installation is to be used as an established school crossing, pedestrian signals shall be located and mounted in the manner specified in sections 7D-14 and 7D-15.

7D-27 Signal Control

When an existing traffic signal installation is to be used as an established school crossing, the control of the pedestrian signal indications may be accomplished with the timing mechanism normally employed for the traffic signal. For this type of operation, the pedestrian phase or indication is given at a predetermined point during each cycle, or a push button is used to introduce the pedestrian phase or indication (in accordance with the needs of pedestrian traffic).

7D-28 Signal Operation

When an intersection with an existing traffic signal installation is to be used as an established school crossing, the pedestrian crossing interval can be combined with the vehicular movements in one of the four basic ways set forth in section 7D-9.

The timing of the pedestrian crossing phase shall be in conformance with the provisions of section 7D-9.

the traffic signal. For this type of operation, the pedestrian phase or indication is given at a predetermined point during each cycle, or a push button is used to introduce the pedestrian phase or indication (in accordance with the needs of pedestrian traffic).

7D-28 Signal Operation

When an intersection with an existing traffic signal installation is to be used as an established school crossing, the pedestrian crossing interval can be combined with the vehicular movements in one of the four basic ways set forth in section 7D-9.

The timing of the pedestrian crossing phase shall be in conformance with the provisions of section 7D-9.

E. CROSSING SUPERVISION

7E-1 Types of Crossing Supervision

There are two types of school crossing supervision:

1. Adult control of pedestrians and vehicles with adult guards or police officers.
2. Student control of only pedestrians with student patrols.

Recommended practices for the organization, operation and administration of an adult crossing guard program are given in Civilian Guards For School Crossings* and Adult School Crossing Guards.**

Recommended practices for the organization, administration and operation of a student patrol program are given in Policies and Practices for School Safety Patrols.**

7E-2 Adult Guards

Adult guards may be used to provide gaps in traffic at school crossings where an engineering study has shown that adequate gaps must be created (sec. 7A-3).

7E-3 Legal Authority for Adult Guards

Adult guards should be special police officers appointed by the local police agency.

The local police agency should be responsible for the selection, training and supervision of adult guards.

7E-4 Choice of Adult Guards

High standards for selection of adult guards are essential. Adult guards must understand children and in addition should possess the following qualifications:

1. Average intelligence
2. Good physical condition, including sight and hearing
3. Mental alertness
4. Neat appearance
5. Good character
6. Dependable
7. Sense of responsibility for safety of children.

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* Available from the Traffic Institute of Northwestern University.

** Available from the American Automobile Association, Falls Church, VA 22047.

7E-5 Uniform of Adult Guards

Adult guards should be uniformed so that motorists and pedestrians can recognize them and respond to their signals. It is recommended that their uniforms be distinctively different from those worn by regular police officers.

During periods of twilight or darkness, adult guards and student patrols should wear either reflective material or reflective clothing.

II-45(c)
Rev. 3

7E-6 Operating Procedures for Adult Guards

Adult guards should not direct traffic in the usual police regulatory sense. In the control of traffic, they should pick opportune times to create a safe gap. At these times, their presence in the roadway serves as an easily recognized indication that pedestrians are about to use the crosswalk, and that all traffic must stop. Adult crossing guards may use an 18″ stop paddle, similar to the one set forth in section 6F-2, except that the paddle shall have "STOP" on one or both sides and that it shall be reflectorized or illuminated when used during hours of darkness. The legend shall be at least 6″ series capital letters. When all traffic has stopped, the adult guard allows the children to cross.

7E-7 Police Officers

Police officers should be used for school crossing supervision only in emergency situations on a temporary basis or at very hazardous school crossings where the use of adult guards is not feasible.

7E-8 Student Patrols

Student patrols may be used to direct and control children at crossings near schools where there is no need to create adequate gaps in traffic.

Student patrols may be used to direct and control children at signalized intersections where turning movements are not a problem, and to assist adult guards in the control of children at crossing locations used by large numbers of children.

Student patrols should not be responsible for directing vehicular traffic. They should not function as police.

7E-9 Legal Authority for Student Patrols

Student patrols should be authorized by the local school board. School authorities should be responsible for organizing, instructing and supervising patrols with the assistance of the local police.

7E-10 Choice of Student Patrols

Student patrols should be carefully selected. They should be children from the 5th grade or higher. Leadership and reliability should be determining qualities for patrol membership.

Parental approval should be obtained in writing before a child is used as a member of a student patrol.

7E-11 Operating Procedures for Student Patrols

Student patrols control children, not vehicles. They should stop children back of the curb or edge of the roadway and allow them to cross only when there is an adequate gap in traffic. Flagging devices used during periods of twilight or darkness shall be reflective or illuminated. II-45(c) Rev. 3

F. GRADE SEPARATED CROSSINGS

7F-1 Function

Grade separated crossings may be used to physically separate the crossing of a very heavy volume of school pedestrian traffic and a heavy vehicular flow.

7F-2 Types of Grade Separated Crossings

Grade separated crossings may be either overpasses or underpasses. The design should follow the guidelines given in the published policies of the American Association of State Highway and Transportation Officials.* Experience has shown that for pedestrian crossings overpasses are more satisfactory than underpasses, as overpasses are easier to maintain and supervise.

7F-3 Criteria for Use of Grade Separated Crossings

Grade separated crossings should be considered only when the physical characteristics of the location make such a structure feasible. If use of the grade separation will be less convenient than an at-grade crossing, barriers or supervision will be needed to assure a satisfactory level of use.

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*A Policy on Geometric Design of Highways and Streets, 1984.

☆U.S. GOVERNMENT PRINTING OFFICE: 1986-155-985

PART VIII
Grade Crossings

Part VIII. TRAFFIC CONTROL SYSTEMS FOR RAILROAD — HIGHWAY GRADE CROSSINGS

A. GENERAL

8A-1 Functions

Traffic control systems for railroad-highway grade crossings include all signs, signals, markings, and illumination devices and their supports along highways approaching and at railroad crossings at grade. The function of these systems is to permit safe and efficient operation of rail and highway traffic over crossings. Traffic control devices shall be consistent with the design and application of the standards contained herein. For the purpose of installation, operation, and maintenance of devices constituting traffic control systems at railroad-highway grade crossings, it is recognized that any crossing of a public road and a railroad is situated on right-of-way available for the use of both highway traffic and railroad traffic on their respective roadways and tracks.

With due regard for safety and for the integrity of operations by highway and railroad users, the highway agency and the railroad company are entitled to jointly occupy the right-of-way in the conduct of their assigned duties. This requires joint responsibility in the traffic control function between the public agency and the railroad. The determination of need and selection of devices at a grade crossing is made by the public agency with jurisdictional authority. Subject to such determination and selection, the design, installation and operation shall be in accordance with the national standards contained herein.

8A-2 Use of Standard Devices

The grade crossing traffic control devices, systems, and practices described herein are intended for use both in new installations and at locations where general replacement of present apparatus is made, consistent with Federal and State laws and regulations. To stimulate effective reaction of vehicle operators and pedestrians, these devices, systems, and practices utilize the five basic considerations: design, placement, operation, maintenance, and uniformity employed generally for traffic control devices and described fully in section 1A-2.

8A-3 Uniform Provisions

All signs used in grade crossing traffic control systems shall be reflectorized to show the same shape and color to an approaching motorist both by day and by night. Reflectorization may be by one of the methods described in section 2A-18.

Normally, where the distance between tracks, measured along the highway, exceeds 100 feet, additional signs or other appropriate traffic control devices should be used.

No sign or signal shall be located in the center of an undivided roadway except in an island with barrier curbs installed in accordance with the general requirements of Part V with minimum clearance of 2 feet from the face of each curb.

Where it is practical, equipment housing should provide a lateral clearance of 30 feet from the roadway. Adequate clearance should also be provided from tracks in order to reduce the obstruction to motorists sight distance and to reduce the possibility of damage to the housed equipment.

8A-4 Crossing Closure

Any highway grade crossing for which there is not a demonstrated need should be closed.

8A-5 Traffic Controls During Construction and Maintenance

Traffic controls for street and highway construction and maintenance operations are discussed in Part VI of this manual. Similar traffic control methods should be used where highway traffic is affected by construction and maintenance at grade crossings.

Public and private agencies should meet to plan appropriate detours and necessary signing, marking, and flagging requirements for successful operations during the closing. Pertinent considerations include length of time for crossing to be closed, type of traffic affected, time of day, materials and techniques of repair. Inconvenience, delay, and accident potential to affected traffic should be minimized to the extent practical. Prior notice should be extended to affected public or private agencies before blockage or infringement on the free movement of vehicles or trains.

Construction or maintenance techniques should not extensively prolong the closing of the crossing. The width and riding quality of the roadway surface at a grade crossing should, as a minimum, be restored to correspond with the approaches to the crossing.

B. SIGNS AND MARKINGS

8B-1 Purpose

Passive traffic control systems, consisting of signs, pavement markings, and grade crossing illumination, identify and direct attention to the location of a grade crossing, to permit vehicle operators and pedestrians to take appropriate action.

Where a railroad track has been abandoned or its use discontinued, all related traffic control devices shall be removed, and the tracks should be removed or covered.

8B-2 Railroad Crossing (Crossbuck) Sign (R15-1, 2)

The railroad crossing sign, commonly identified as the "crossbuck" sign, as a minimum shall be white reflectorized sheeting or equal, with the words RAILROAD CROSSING in black lettering. As a minimum, one crossbuck sign shall be used on each roadway approach to every grade crossing, alone or in combination with other traffic control devices. If there are two or more tracks between the signs, the number of tracks shall be indicated on an auxiliary sign of inverted T shape mounted below the crossbuck in the manner and at the heights indicated in figure 8-1 except that use of this auxiliary sign is optional at crossings with automatic gates.

Where physically feasible and visible to approaching traffic the crossbuck sign shall be installed on the right hand side of the roadway on each approach to the crossing. Where an engineering study finds restricted sight distance or unfavorable road geometry, crossbuck signs shall be placed back to back or otherwise located so that two faces are displayed to each approach.

Crossbuck signs should be located with respect to the roadway pavement or shoulder in accordance with the criteria in sections 2A-21 through 2A-27 and figures 2-1 and 2-2 (pages 2A-9 and 2A-10) and should be located with respect to the nearest track in accordance with signal locations in figure 8-7, (page 8C-6). The normal lateral clearances (sec. 2A-24), 6 feet from the edge of the highway shoulder or 12 feet from the edge of the traveled way in rural areas and 2 feet from the face of the curb in urban areas will usually be attainable. Where unusual conditions demand, variations determined by good judgment should provide the best possible combination of view and safety clearances attainable, occasionally utilizing a location on the left-hand side of the roadway.

Appropriate details of R15-1 and R15-2 are available in the Standard Highway Signs Booklet.*

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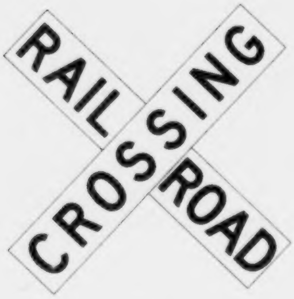
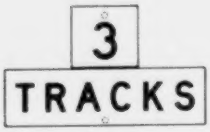
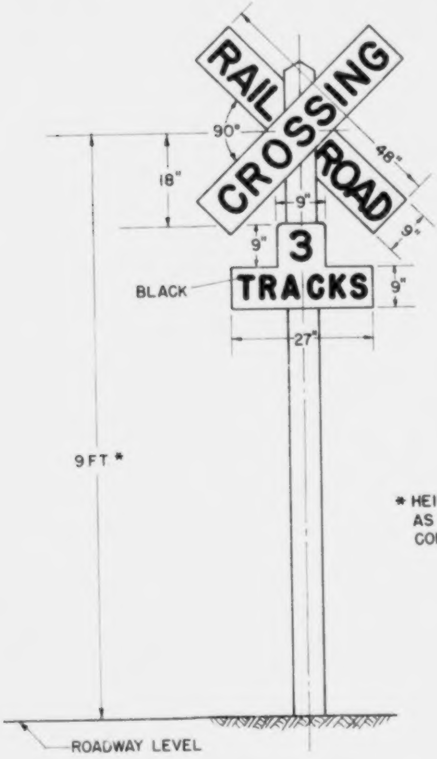
* Available from Federal Highway Administration (HTO-20) Washington, D.C. 20590


RAIL
ROAD
CROSSING

R15-1
48" x 9"
(drilled for 90-degree mounting)



R15-2
9" x 9"
27" x 9"


RAIL
ROAD
CROSSING
90°
18"
48"
9"
9"
9"
3
TRACKS
BLACK
9"
27"
9 FT *
ROADWAY LEVEL

* HEIGHT MAY BE VARIED
AS REQUIRED BY LOCAL
CONDITIONS.

Figure 8-1. Railroad-highway crossing (crossbuck) sign.

8B-3 Railroad Advance Warning Signs (W10-1, 2, 3, 4)

A Railroad Advance Warning (W10-1) sign shall be used on each roadway in advance of every grade crossing except:

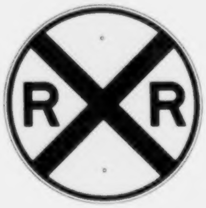
1. On low-volume, low-speed roadways crossing minor spurs or other tracks that are infrequently used and which are flagged by train crews.

2. In the business districts of urban areas where active grade crossing traffic control devices are in use.

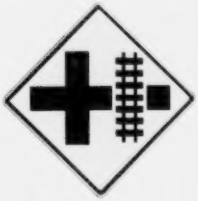
3. Where physical conditions do not permit even a partially effective display of the sign.

Placement of the sign shall generally be in accordance with Section 2C-3 and Sections 2A-21 to 2A-27, normally 750 feet or more in advance of the crossing in rural areas and 250 feet in advance of the crossing in urban areas, except that in a residential or business district where low speeds are prevalent, the signs may be placed a minimum distance of 100 feet from the crossing. On divided highways and one-way roads, it is desirable to erect an additional sign on the left side of the roadway. VIII-2 (c)

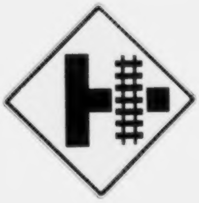
The W10-2, 3, and 4 signs may be installed on highways that are parallel to railroads. The purpose of these signs is to warn a motorist making a turn that a railroad crossing is ahead. Where there is 100 feet or more between the railroad and the parallel highway, a W10-1 sign should be installed in advance of the railroad crossing and the W10-2, 3, or 4 signs on the parallel highway would not be necessary.



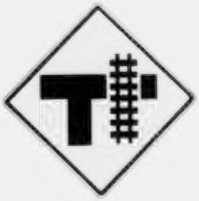
W10-1
36″ Diameter



W10-2
30″ × 30″

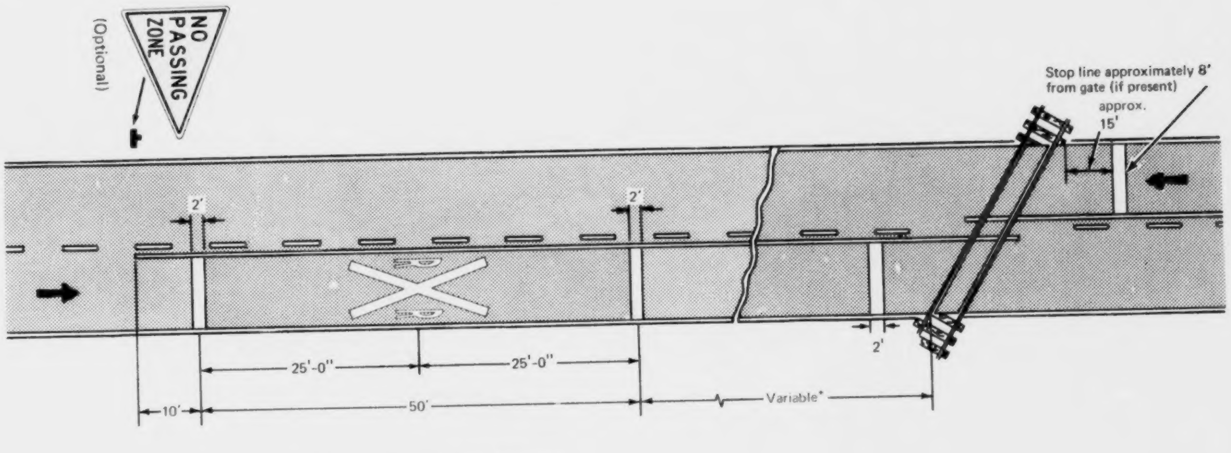


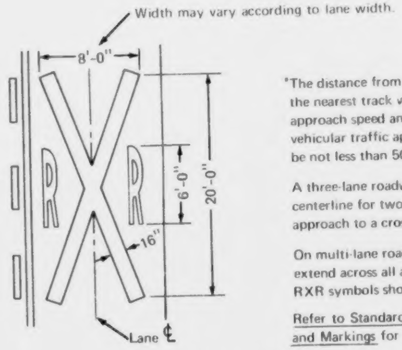
W10-3
30″ × 30″



W10-4
30″ × 30″

VIII-2 (c)


NO PASSING ZONE
(Optional)
Stop line approximately 8' from gate (if present)
approx. 15'
2'
2'
2'
25'-0"
25'-0"
10'
50'
Variable*


Width may vary according to lane width.
8'-0"
6'-0"
20'-0"
16"
R
X
R
Lane ℄

*The distance from the railroad crossing marking to the nearest track will vary according to the approach speed and the sight distance of the vehicular traffic approaching, but probably should be not less than 50 feet.

A three-lane roadway should be marked with a centerline for two-lane approach operation on the approach to a crossing.

On multi-lane roads the transverse bands should extend across all approach lanes, and individual RXR symbols should be used in each approach lane.

Refer to Standard Alphabet for Highway Signs and Markings for RXR symbols details.

Figure 8-2. Typical pavement markings at railroad-highway grade crossings.

8B-4 Pavement Markings

Pavement markings in advance of a grade crossing shall consist of an X, the letters RR, a no passing marking (2-lane roads), and certain transverse lines. Identical markings shall be placed in each approach lane on all paved approaches to grade crossings where grade crossing signals or automatic gates are located, and at all other grade crossings where the prevailing speed of highway traffic is 40 mph or greater.

The markings shall also be placed at crossings where the engineering studies indicate there is a significant potential conflict between vehicles and trains. At minor crossings or in urban areas, these markings may be omitted if engineering study indicates that other devices installed provide suitable control.

The design of railroad crossing pavement markings shall be essentially as illustrated in figure 8-2. The symbols and letters are elongated to allow for the low angle at which they are viewed. All markings shall be reflectorized white except for the no-passing markings which shall be reflectorized yellow.

8B-5 Illumination at Grade Crossings

At grade crossings where a substantial amount of railroad operation is conducted at night, particularly where train speeds are low, where crossings are blocked for long periods, or accident history indicates that motorists experience difficulty in seeing trains or control devices during the hours of darkness, illumination at and adjacent to the crossing may be installed to supplement other traffic control devices where an engineering analysis determines that better visibility of the train is needed. Regardless of the presence of other control devices, illumination will aid the motorist in observing the presence of railroad cars on a crossing where the gradient of the vehicular approaches is such that the headlights of an oncoming vehicle shine under or over the cars.

Recommended types and location of luminaires for grade crossing illumination are contained in the American National Standard Practice for Roadway Lighting, RP8.* In any event, luminaires shall be so located and light therefrom so directed as to not interfere with aspects of the railroad signal system and not interfere with the field of view of members of the locomotive crew.

8B-6 Exempt Crossing Signs (R15-3, W10-1a)

When authorized by law or regulation a supplemental sign (R15-3) bearing the word EXEMPT may be used below the Crossbuck and Track signs at the crossing, and supplemental sign (W10-1a) may be used below the Railroad Advance Warning sign. These supplemental signs are to inform drivers of vehicles carrying passengers for hire, school buses carrying children, or vehicles carrying flammable or hazardous materials that a stop is not required at certain designated grade crossings, except when a train, locomotive, or other railroad equipment is approaching or occupying the crossing or the driver's view of the sign is blocked.

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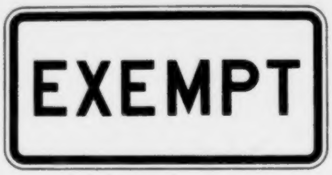
* Available from the Illuminating Engineering Society, New York, N.Y. 10017.



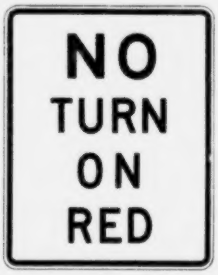
R15-3 White background
W10-1a Yellow background

8B-7 Turn Restrictions

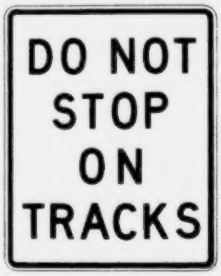
At a signalized highway intersection within 200 feet of a grade crossing, where the intersection traffic control signals are preempted by the approach of a train, all existing turning movements toward the grade crossing should be prohibited by proper placement of a NO RIGHT TURN sign (R3-1a) or a NO LEFT TURN sign (R3-2a) or both. In each case, these signs shall be visible only when the restriction is to be effective. A blank-out, internally illuminated, or other similar type sign may be used to accomplish this objective. The signs shall be black on white and have a standard size of 24" × 30".

8B-8 Do Not Stop on Tracks Sign (R8-8)

Whenever an engineering study determines that the potential for vehicles stopping on the tracks is high, a DO NOT STOP ON TRACKS sign should be used. The sign should normally be placed on the far right side of the grade crossing. On multilane roads and one-way roadways a second sign should be placed on the far left side of the grade crossing.



R10-11
24" × 30"



R8-8
24" × 30"

8B-9 STOP Signs at Grade Crossings (R1-1, W3-1)

The use of the STOP signs at railroad-highway grade crossings shall be limited to those grade crossings selected after need is established by a detailed traffic engineering study. Such crossings should have the following characteristics:

1. Highway should be secondary in character with low traffic counts.
2. Train traffic should be substantial.
3. Line of sight to an approaching train is restricted by physical features such that approaching traffic is required to reduce speed to 10 miles per hour or less in order to stop safely.
4. At the stop bar, there must be sufficient sight distance down the track to afford ample time for a vehicle to cross the track before the arrival of the train. VIII-5 (c)

The engineering study may determine other compelling reasons for the need to install a STOP sign, however, this should only be an interim measure until active traffic control signals can be installed. STOP signs shall not be used on primary through highways or at grade crossings with active traffic control devices.

Whenever a STOP sign is installed at a grade crossing, a Stop Ahead sign shall be installed in advance of the STOP sign.

C. SIGNALS AND GATES

8C-1 Purpose and Meaning

Active traffic control systems inform motorists and pedestrians of the approach or presence of trains, locomotives, or railroad cars on grade crossings. The meaning of flashing light signals and gates shall be as defined in the Uniform Vehicle Code (secs. 11-701 & 11-703, Revised 1968).*

8C-2 Flashing Light Signal—Post Mounted

When indicating the approach or presence of a train, the flashing light signal, illustrated in figure 8-3, shall display toward approaching highway traffic the aspect of two red lights in a horizontal line flashing alternately. As shown in figure 8-3, the typical flashing light signal assembly on a side of the roadway location includes a standard crossbuck sign and, where there is more than one track, an auxiliary "number of tracks" sign, all of which indicate to vehicle operators and pedestrians at all times the location of a grade crossing. A bell may be included in the assembly and operated in conjunction with the flashing lights. Bells are a particularly suitable warning for pedestrians and bicyclists.

The flashing light signals should normally be placed to the right of approaching highway traffic on all roadway approaches to a crossing. They should be located laterally with respect to the highway in conformance with figure 8-6, (page 8C-5) except where such location would compromise signal display effectiveness. As stated in section 8A-3, if it is practical, equipment housings (controller cabinets) should have a lateral clearance of 30 feet from the roadway and adequate clearance from the tracks. Where conditions warrant, escape areas, attenuators, or guardrails should be provided.

Additional pairs of lights may be mounted on the same supporting post and directed toward vehicular traffic approaching the crossing from other than the principal highway route. Such may well be the case where there are approaching routes on roadways closely adjacent to and parallel to the railroad. At crossings of a highway with traffic in both directions, back-to-back pairs of lights shall be placed on each side of the tracks. On one way streets and divided highways, signals shall be placed on the approach side of the crossing normally on both sides of the roadway and may be equipped with back lights. Typical location plans for signals are shown in figure 8-7, (page 8C-6).

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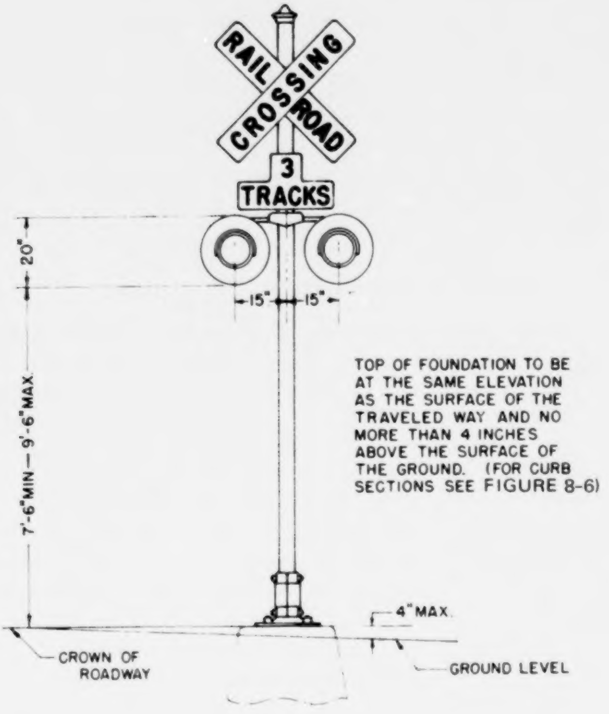
* National Committee on Uniform Traffic Laws and Ordinances, 1776 Massachusetts Ave., N.W., Washington, D.C. 20036.



TOP OF FOUNDATION TO BE AT THE SAME ELEVATION AS THE SURFACE OF THE TRAVELED WAY AND NO MORE THAN 4 INCHES ABOVE THE SURFACE OF THE GROUND. (FOR CURB SECTIONS SEE FIGURE 8-6)

Figure 8-3. Typical flashing light signal—post mounted.

8C-3 Flashing Light Signal—Cantilever Supported

Where required for better visibility to approaching traffic, particularly on multi-lane approaches, cantilevered flashing light signals are used in the manner shown in figure 8-4. In addition to the flashing lights cantilevered over the roadways, flashing lights should usually be placed on the supporting post.

Although cantilever signals are more commonly used on multi-lane highways, they are also suitable for other locations where additional emphasis is needed. These locations may include high speed rural highways, high volume two-lane highways, or specific locations where there are distractions. If one pair of cantilever flashing lights would be visible to drivers in all approaching lanes, except the right lane which has a view of the post mounted signals, other flashing lights are not required on the cantilever arm. A pair of lights overhead for each approaching

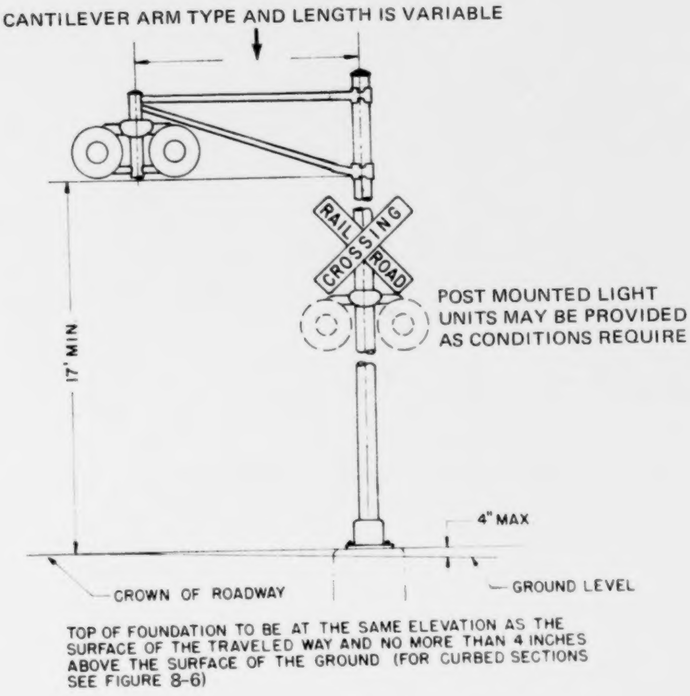

CANTILEVER ARM TYPE AND LENGTH IS VARIABLE
RAIL ROAD
CROSSING
POST MOUNTED LIGHT UNITS MAY BE PROVIDED AS CONDITIONS REQUIRE
17' MIN
4" MAX
CROWN OF ROADWAY
GROUND LEVEL
TOP OF FOUNDATION TO BE AT THE SAME ELEVATION AS THE SURFACE OF THE TRAVELED WAY AND NO MORE THAN 4 INCHES ABOVE THE SURFACE OF THE GROUND (FOR CURBED SECTIONS SEE FIGURE 8-6)

Figure 8-4. Typical flashing light signal—cantilever supported.

lane is not required, inasmuch as the warning aspect is at all times identical for all.

Breakaway or frangible bases shall not be used for cantilever signal supports. Where conditions warrant, escape area, attenuators, or properly designed guardrails should be provided.

8C-4 Automatic Gate

An automatic gate is a traffic control device used as an adjunct to flashing lights. The device consists of a drive mechanism and a fully reflectorized red and white striped gate arm with lights, and which in the down position extends across the approaching lanes of highway traffic about 4 feet above the top of the pavement. The flashing light signal may be supported on the same post with the gate mechanism or separately mounted. A schematic view of the gate arm in the down position is shown in figure 8-5. This view does not show any of the several mechanisms used to raise and lower the arm.

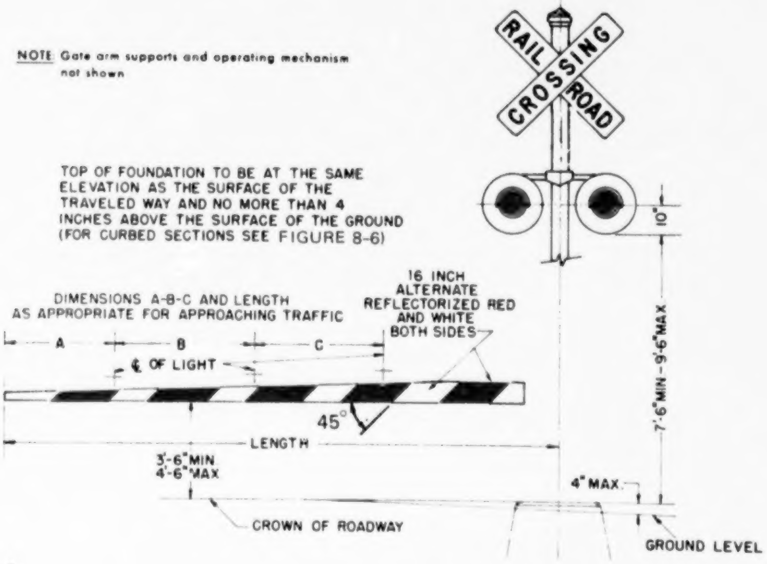
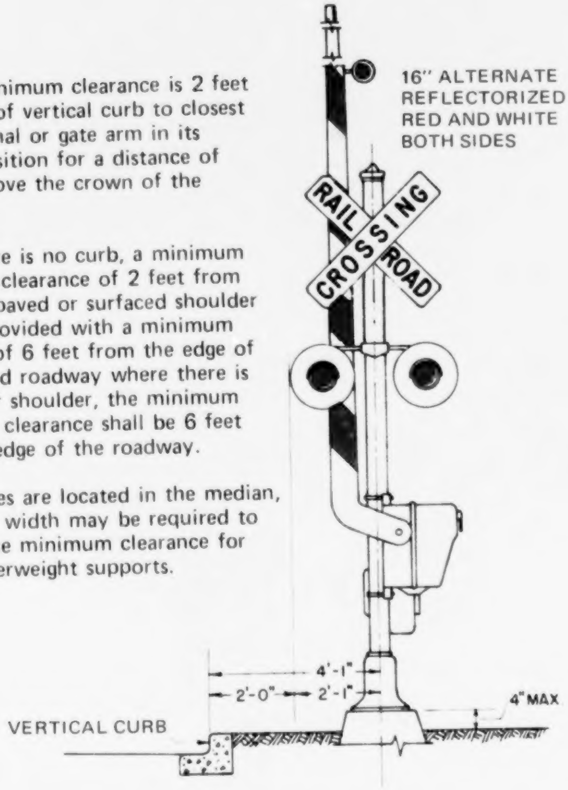

NOTE Gate arm supports and operating mechanism not shown
RAIL ROAD
CROSSING
TOP OF FOUNDATION TO BE AT THE SAME ELEVATION AS THE SURFACE OF THE TRAVELED WAY AND NO MORE THAN 4 INCHES ABOVE THE SURFACE OF THE GROUND (FOR CURBED SECTIONS SEE FIGURE 8-6)
10"
16 INCH ALTERNATE REFLECTORIZED RED AND WHITE BOTH SIDES
DIMENSIONS A-B-C AND LENGTH AS APPROPRIATE FOR APPROACHING TRAFFIC
A
B
C
℄ OF LIGHT
7'-6" MIN - 9'-6" MAX
45°
LENGTH
3'-6" MIN
4'-6" MAX
4" MAX.
CROWN OF ROADWAY
GROUND LEVEL

Figure 8-5. Schematic view of automatic gate.

In its normal upright position, when no train is approaching or occupying the crossing, the gate arm should be either vertical or nearly so (fig. 8-6). Typical minimum clearance is 2 feet from face of vertical curb to closest part of signal or gate arm in its upright position for a distance of 17 feet above the crown of the roadway. Where there is no curb, a minimum horizontal clearance of 2 feet from edge of a paved or surfaced shoulder shall be provided with a minimum clearance of 6 feet from the edge of the traveled roadway. Where gates are located in the median, additional width may be required to provide the minimum clearance for the counterweight supports. Where conditions warrant, escape routes, attenuators, or guardrails should be provided.

In a normal sequence of operation the flashing light signals and the lights on the gate arm in its normal upright position are activated immediately upon detection of the approach of a train. The gate arm shall start its downward motion not less than 3 seconds after the signal lights start to operate, shall reach its horizontal position before the arrival of any train, and shall remain in that position as long as the train occupies the crossing. When the train clears the crossing, and no other train is approaching, the gate arm shall ascend to its upright position normally



Typical minimum clearance is 2 feet from face of vertical curb to closest part of signal or gate arm in its upright position for a distance of 17 feet above the crown of the roadway.

Where there is no curb, a minimum horizontal clearance of 2 feet from edge of a paved or surfaced shoulder shall be provided with a minimum clearance of 6 feet from the edge of the traveled roadway where there is no curb or shoulder, the minimum horizontal clearance shall be 6 feet from the edge of the roadway.

Where gates are located in the median, additional width may be required to provide the minimum clearance for the counterweight supports.

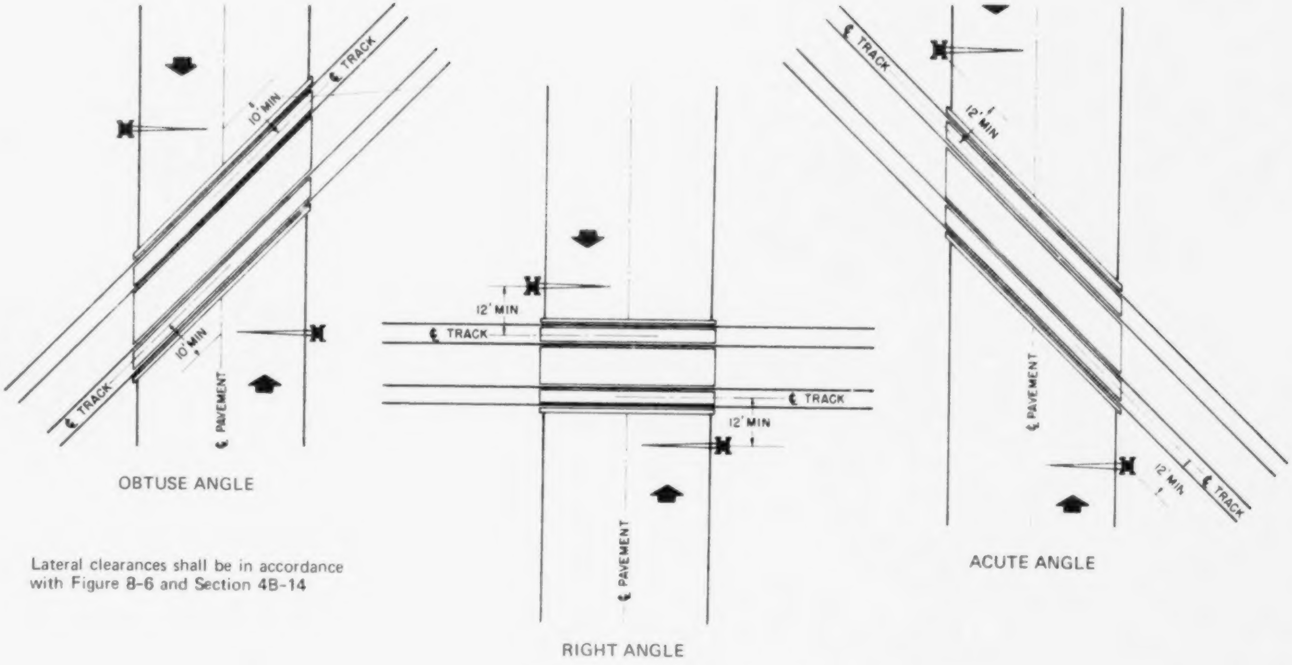
Figure 8-6. Typical clearances for flashing light signals and automatic gates.

in not more than 12 seconds, following which the flashing lights and the lights on the gate arm shall cease operation. In the design of individual installations, consideration should be given to timing the operation of the gate arm to accommodate slow moving trucks. Timing the operation of the gate arm shall be coordinated with the pre-emption sequence of adjacent traffic control signals.

Typical location plans for automatic gates at crossings are shown in figure 8-7. Component details are described in section 8C-7.

8C-5 Train Detection

To serve their purpose of advising motorists and pedestrians of the approach or presence of trains, locomotives, or railroad cars on grade


€ TRACK
10' MIN
10' MIN
€ TRACK
€ PAVEMENT
OBTUSE ANGLE
12' MIN
€ TRACK
€ TRACK
12' MIN
€ PAVEMENT
RIGHT ANGLE
€ TRACK
12' MIN
€ PAVEMENT
12' MIN
€ TRACK
ACUTE ANGLE

Lateral clearances shall be in accordance with Figure 8-6 and Section 4B-14

Figure 8-7. Typical location plan for flashing light signals and automatic gates.

crossings, the devices employed in active traffic control systems shall be actuated by some form of train detection. Generally the method is automatic, requiring no personnel to operate it, although a small number of such installations are still operated under manual control. The automatic method currently uses the railroad circuit.*

Railroad circuits insofar as practical shall be designed on the fail safe principle, which uses closed circuits.

On tracks where trains operate at speeds of 20 mph or higher, circuits controlling automatic flashing light signals shall provide for a minimum operation of 20 seconds before arrival of any train on such track. On other tracks used for switching and assembling trains a means shall be provided to warn approaching highway traffic. For automatic gate operation, circuits shall provide for the operating sequence described in section 8C-4.

Where the speeds of different trains on a given track vary considerably under normal operation, special devices or circuits should be installed to provide reasonably uniform notice in advance of all train movements over the crossing. Special control features should be used to eliminate the effects of station stops and switching operations within approach control circuits.

8C-6 **Traffic Signals at or Near Grade Crossings (fig. 8-8)**

When highway intersection traffic control signals are within 200 feet of a grade crossing, control of the traffic flow should be designed to provide the vehicle operators using the crossing a measure of safety at least equal to that which existed prior to the installation of such signals. Accordingly, design, installation, and operation should be based upon a total systems approach in order that all relevant features may be considered.

When the grade crossing is equipped with an active traffic control system, the normal sequence of highway intersection signal indications should be preempted upon approach of trains to avoid entrapment of vehicles on the crossing by conflicting aspects of the highway traffic signals and the grade crossings signals. This preemption feature requires an electrical circuit between the control relay of the grade crossing signals and the controller assembly in order to establish and maintain the preempted condition during the time that the grade crossing signals are in operation. Where multiple or successive preemption may occur from differing modes, train actuation should receive first priority and emergency vehicles second priority.

Where a signalized highway intersection is adjacent to a grade crossing not provided with an active traffic control system, the possibility of vehicles being trapped on the crossing remains and preemption of the signal controller is usually required. However, at some locations, the characteristics of the crossing and intersection area along with favorable speeds of both vehicular and train traffic may permit alternate methods of warning traffic. Where preemption of the traffic signal control is determined to be desirable, consideration should be given to the installation of active traffic control devices at the grade crossing, inasmuch as the cost of the grade crossing devices would usually represent a minor addition to the cost of the railroad circuits required for the preemption function.

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*Definition: "Railroad Circuit—A control circuit which includes all train movement detection and logic components which are physically and/or electrically integrated with track structures or associated manual control."

Except under unusual circumstances, preemption should be limited to the highway intersection traffic signals within 200 feet of the grade crossing.

The preemption sequence initiated when the train first enters the approach circuit, shall at once bring into effect a highway signal display which will permit traffic to clear the tracks before the train reaches the crossing. The preemption shall not cause any short vehicular clearances and all necessary vehicular clearances shall be provided. However, because of the relative hazards involved, pedestrian clearances may be abbreviated in order to provide the track clearance display as early as possible.

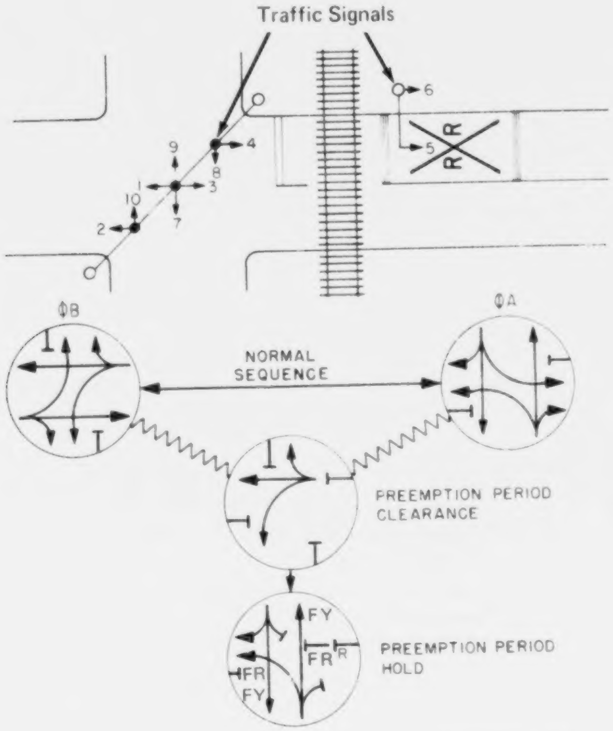
To avoid misinterpretation during the time the clear-out signals are green, consideration should be given to the use of 12-inch red lenses in the signals which govern highway traffic movement over the crossing with adequately screened or louvered green lenses in the clear-out signals beyond the crossing.

After the track clearance phase, the highway intersection traffic control signals should be operated to permit vehicle movements that do not cross the tracks, but shall not provide a through circular green or arrow indication for movements over the tracks. This does not prohibit green indications for highway traffic movements on a roadway paralleling the tracks.

Where feasible, traffic control signals near grade crossings should be operated so that vehicles are not required to stop on the tracks even though in some cases this will increase the waiting time. The exact nature of the display and the location of the signals to accomplish this will depend on the physical relationship of the tracks to the intersection area.

Highway traffic control signals shall not be used on mainline railroad crossings in lieu of flashing light signals. However, at industrial track crossings and other places where train movements are very slow (as in switching operations), highway traffic control signals may be used in lieu of conventional flashing light signals to warn vehicle operators of the approach or presence of a train. The provisions of this part relating to traffic signal design, installation, and operation are applicable as appropriate where highway traffic signals are so used.

Figure 8-8 illustrates typical traffic signal phasing where preemption is used.


Traffic Signals
1
2
3
4
5
6
7
8
9
10
R R
ΦB
ΦA
NORMAL SEQUENCE
PREEMPTION PERIOD CLEARANCE
FY
FR
R
FR
FY
PREEMPTION PERIOD HOLD

Signal	ϕA		ϕB			PREEMPTION SEQUENCE					
	R/W	Clear	R/W	Clear_1	Clear_2	Ph_A Clear	Ph_B Clear		Hold	Clear	Release
1, 2	R	R	G	G	Y	R	Y	R	FR	R	G
3, 4	R	R	G	G	Y	R	G	Y	FR	R	G
5, 6	R	R	G	Y	R	R	Y	R	R	R	G
7, 8	G	Y	R	R	R	Y	R	R	FY	Y	R
9, 10	G	Y	R	R	R	Y	R	R	FY	Y	R

Figure 8-8. Typical preemption sequence.

8C-7 Component Details

Gate arms shall be fully reflectorized having diagonal stripes alternately red and white at 16-inch intervals measured horizontally and shall have at least three red lights as indicated in figure 8-5 (page 8C-4).

When activated, the gate arm light nearest the tip shall be illuminated continuously and the other two lights shall flash alternately in unison with the flashing light signals.

Flashing light units shall flash alternately. The number of flashes per minute for each incandescent lamp shall be 35 minimum and 55 maximum. Each lamp shall be illuminated approximately the same length of time. Total time of illumination of each pair of incandescent lamps shall be practically the entire operating time.

Where local conditions will permit, a lateral escape route to the right of the highway in advance of the grade crossing traffic control device should be kept free of guardrail or other ground obstruction. Where guardrail is not deemed necessary nor appropriate, rigid non-yielding type barriers are not to be used for protecting signal supports. In industrial or other areas involving only low-speed highway traffic and where signals are vulnerable to damage by turning truck traffic, ring type guardrail may be installed to provide protection for the signal assembly.

The same lateral clearances and roadside safety features should apply to flashing light signal and automatic gate locations on both the right and left sides of the roadway.

Two sizes of lenses, 8-inch diameter and 12-inch diameter, are available for flashing light signal units. The larger lens provides somewhat better visibility. In choosing between the two sizes of lenses, consideration should be given to the principles stated in section 4B-8 for choosing between the 8-inch and 12-inch lenses for use in highway intersection traffic control signals.

The requirement for storage battery source of standard power for signal and gate operation during outages in the primary power source limits the operating voltage to 10 and the maximum lamp wattage is generally 25.

Many other details of grade crossing traffic control systems which are not set forth herein are contained in references in 1A-7.

D. SYSTEMS AND DEVICES

8D-1 Selection of Systems and Devices

The selection of traffic control devices at a grade crossing is determined by public agencies having jurisdictional responsibility at specific locations.

Active grade crossing traffic control systems range from

1. post mounted flashing light signals to
2. automatic gates combined with
    - (a) post mounted flashing light signals,
    - (b) cantilever flashing light signals, or
    - (c) combination of the above

Any of the foregoing may or may not incorporate a bell.

Due to the large number of significant variables which must be considered there is no single standard system of active traffic control devices universally applicable for grade crossings. Based on an engineering and traffic investigation, a determination is made whether any active traffic control system is required at a crossing and, if so, what type is appropriate. Before a new or modified grade crossing traffic control system is installed, approval is required from the appropriate agency within a given State.

Part IX. TRAFFIC CONTROLS FOR BICYCLE FACILITIES

A. GENERAL

9A-1 Requirements for Bicyclist Traffic Control Devices

Traffic control devices, whether they are intended for motorists or bicyclists, must adhere to five basic requirements to be able to perform their intended function. They must:

1. Fulfill a need.
2. Command attention.
3. Convey a clear, simple meaning.
4. Command respect of road users.
5. Give adequate time for proper response.

The design, placement, operation, maintenance, and uniformity of traffic control devices must be considered to meet the above requirements. Design is a critical feature to permit the device to fulfill a need and to command respect of road users. The placement—lateral, vertical, and longitudinal—plays an important part in making the device effective and in giving adequate time for proper response. The operation of traffic in response to the device is, of course, the critical test of the device's effectiveness and a check on all five of the basic requirements.

Uniformity, achieved by following the recommendations and standards of this Manual, greatly enhances the ability of a device to convey a clear, simple meaning to the user.

Whenever devices are installed, they should be warranted and based on a prior engineering study. Where the guidance provided by this part of the Manual does not fully define where particular devices should be used, qualified traffic engineers should determine the application of devices on any bicycle facility before installation is made. It is intended that this Manual define the standards for traffic control devices, but shall not be a legal requirement for their installation.

9A-2 Scope

This Part covers bicycle-use related signs, pavement markings and signals which may be used on highways or bikeways.

9A-3 Definitions Relating to Bicycles

The following terms are used throughout Part IX:

1. Bikeway—Any road, street, path, or way which in some manner is specifically designated as being open to bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes.
2. Bicycle Trail—A separate trail or path from which motor vehicles are prohibited and which is for the exclusive use of bicycles or the shared use of bicycles and pedestrians. Where such trail or path forms a part of a highway, it is separated from the roadways for motor vehicle traffic by an open space or barrier.
3. Designated Bicycle Lane—A portion of a roadway or shoulder which has been designated for use by bicyclists. It is distinguished from the portion of the roadway for motor vehicle traffic by a paint stripe, curb, or other similar device.
4. Shared Roadway—A roadway which is officially designated and marked as a bicycle route, but which is open to motor vehicle travel and upon which no bicycle lane is designated.
5. Bicycle Route—A system of bikeways designated by appropriate route markers, and by the jurisdiction having authority.

9A-4 Standardization of Devices

Standards for basic design elements and devices using these standards are given in this Manual. These standard devices generally will serve most applications. Where particular conditions require the use of a device that is not included in this Manual, the general principles in this Manual as to color, size, and shape should be followed wherever practical. Such devices should also follow the design, installation and application concepts contained in the Manual.

9A-5 Maintenance

Bicycle signs and markings should be properly maintained to command respect from both the motorist and the bicyclist. When installing signs and markings on bicycle facilities, care should be taken to have an agency designated to maintain these devices.

9A-6 Legal Authority

Traffic control devices shall be placed only by the authority of a public body or official having jurisdiction, for the purpose of regulating, warning, or guiding traffic. No traffic control device or its support shall bear any advertizing or commercial message, or any other message that is not essential to traffic control.

All regulatory devices, if they are to be enforced, need to be backed by applicable laws, ordinances, or regulations.

9A-7 Meanings of "Shall," "Should," and "May"

In this Part as in other parts of the Manual, the words "shall," "should," and "may" are used to describe specific conditions concerning traffic control devices. To clarify the meanings intended by use of these words, the following definitions are provided:

1. SHALL—A *mandatory* condition. Where certain requirements in the design or application of the device are described with the "shall" stipulation, it is mandatory that these requirements be met.
2. SHOULD—An *advisory* condition. Where the word "should" is used, it is considered to be advisable usage, recommended but not mandatory.
3. MAY—A *permissive* condition. No requirement for application is intended. If a particular device is used under a "may" condition, however, its design shall follow the prescribed format.

9A-8 Relation to Other Documents

The Uniform Vehicle Code and Model Traffic Ordinance published by the National Committee on Uniform Traffic Laws and Ordinances, have provisions for bicycles and are used as the legal basis for the control devices included herein. Under the Uniform Vehicle Code, bicycles are generally considered to be vehicles, so the bicyclists have the same privileges and obligations as other drivers.

Informational documents used during the development of the signing and markings recommendations in this part of the Manual include the following:

1. Guide for Bicycles, American Association of State Highway and Transportation Officials, 1974.
2. Bikeways, State of the Art, Federal Highway Administration, 1974.
3. Bicycle Facility Location Criteria, Federal Highway Administration, 1976.
4. Bicycle Facility Design Criteria, Federal Highway Administration, 1976
5. State and municipal design guides.

Other documents which relate to the application of traffic control devices in general, are listed in section 1A-7 of this Manual.

9A-9 Colors

The use of colors for bicycle facility traffic control devices should conform to the color code specified in section 1A-8 for signs and markings. This in part is as follows:

YELLOW—General warning
RED—Stop or prohibition
BLUE—Service guidance

GREEN—Indicated movements permitted, direction guidance
BROWN—Public recreation and scenic guidance
ORANGE—Construction and maintenance warning
BLACK—Regulation
WHITE—Regulation

B. SIGNS

9B-1 Application of Signs

Bicycle-use related signs on highways and bikeways serve three basic purposes: regulating bicycle usage, directing bicyclists along preestablished routes, and warning of unexpected conditions. Care should be taken not to install too many signs. A conservative use of regulatory and warning signs is recommended as these signs, if used to excess, tend to lose their effectiveness. The frequent display of guide signs, however, aids in keeping the bicyclist on the designated route and does not lessen their value. Some signs for the bicyclist can also serve the motorist and the pedestrian.

9B-2 Location and Position

Where signs are to serve both bicyclists and motorists, mounting heights and lateral placement shall be as specified in Part II, Signs. Figure 9-1 illustrates typical signing placement for bicycle trails. Overhead sign clearance on bicycle trails shall be a minimum of 8½ feet. The clearance provided should also be adequate for the typical maintenance vehicles used on the bikeway. Where signs are for the exclusive use of bicyclists, care should be taken that they are located so that motorists are not confused by them.

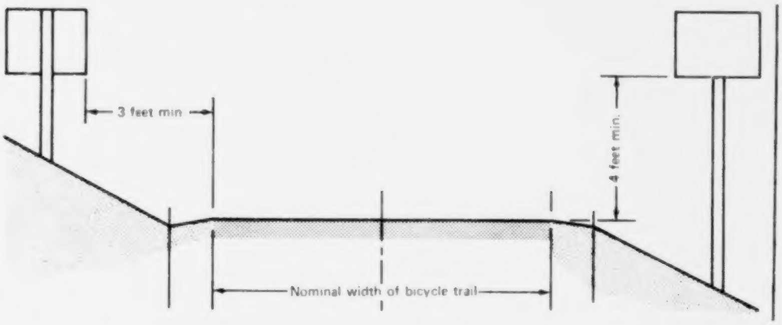


Figure 9-1. Bicycle sign placement on a trail.

9B-3 Design

The design of signs for bicycle facilities should, whenever possible, be identical to that specified in this Manual for motor vehicle travel. Uniformity in design includes shape, color, symbols, wording, lettering, and illumination or reflectorization. Detailed drawings of the standard signs illustrated in this Manual are available to State and local highway and traffic authorities, sign manufacturers, and similar interested agencies.* Standardization of these signs does not preclude further improvement by minor changes in the proportion of symbols, stroke width, and height of letters, or width of borders. However, all shapes and colors shall be as indicated, all symbols shall be unmistakably similar to those shown and (where a word message is applicable) the wording shall be as provided herein.

The sign dimensions shown in this part of the Manual shall be considered standard for application on all types of bicycle facilities. Where signs shown in other parts of this Manual are intended for exclusive bicycle use, smaller sign sizes from that specified may be used. Incremental increases in special bicycle facility signs are also desirable to make the sizes compatible with signs for motor vehicles, where both motorists and bicyclists benefit by a particular sign.

The sign lettering shall be in upper-case letters of the type shown in the Standard Alphabets for Highway Signs and Pavement Markings*

All signs should be reflectorized for bicycle trails as well as for shared roadway and designated bicycle lane facilities.

9B-4 Regulatory Signs

Regulatory signs are to inform bicyclists, pedestrians and motorists of traffic laws or regulations and indicate the applicability of legal requirements that would not otherwise be apparent.

Regulatory signs normally shall be erected at the point where the regulations apply. The sign message shall clearly indicate the requirements imposed by the regulations and shall be easily visible and legible to bicyclists and where appropriate, motorists and pedestrians.

9B-5 Bicycle Prohibition Sign (R5-6)

This sign is intended for use at the entrance to facilities, such as freeways, where bicycling is prohibited. Where pedestrians and motor—driven cycles are also prohibited from using these facilities, it may be more desirable to use the R5-10a word message sign (sec. 2B-28).

In reduced size (18 × 18 inches), this sign may be used on sidewalks where bicycle riding is prohibited.

9B-6 Motor Vehicle Prohibition Sign (R5-3)

This sign is intended for use at the entrance to a bicycle trail.

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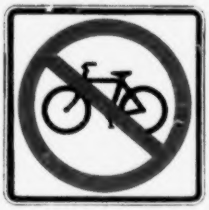
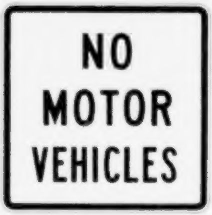
* Available from the Federal Highway Administration (HTO-20) Washington, D.C. 20590



R5-6
24″ × 24″



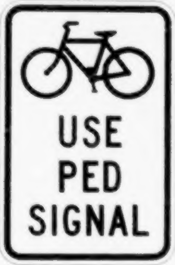
R5-3
24″ × 24″

9B-7 Bicycle Restriction Signs (R9-5 & 6)

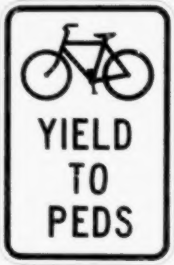
This series of signs is intended for use where pedestrian facilities are being used for bicycle travel. They should be erected off the edge of the sidewalk, near the crossing location, where bicyclists are expected to dismount and walk with pedestrians while crossing the street.

The R9-5 sign may be used where bicycles can cross the street only on the pedestrian walk signal indication.

The R9-6 sign may be used where bicycles are required to cross or share a facility used by pedestrians and are required to yield to the pedestrians.



R9-5
12″ × 18″

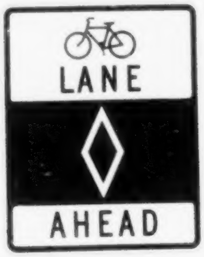


R9-6
12″ × 18″

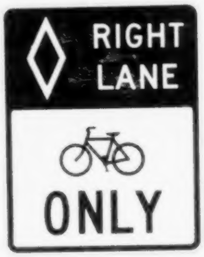
9B-8 Designated Lane Signs (R3-10 & 11)

The R3-10 sign should be used in advance of the beginning of a marked designated bicycle lane to call attention to the lane and to the possible presence of bicyclists. The R3-10 and R3-11 signs should be used only in conjunction with the Preferential Lane Symbol pavement marking and erected at periodic intervals along the designated bicycle lane and in the vicinity of locations where the preferential lane symbol is used (sec. 9C-4).

Where appropriate, the message ENDS may be substituted for AHEAD on the R3-10 sign and LEFT or CURB can be substituted for RIGHT on the R3-11 sign.



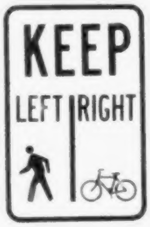
R3-10
24" × 30"



R3-11
24" × 30"

9B-9 Travelpath Restriction Signs (R9-7)

The R9-7 sign is intended for use on facilities which are to be shared by pedestrians and bicycles and on which a designated area is provided for each (sec. 9C-3). Two of these signs may be erected back-to-back with the symbols reversed for the opposite direction.



R9-7
12" × 18"

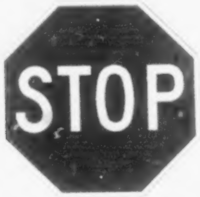
9B-10 STOP and YIELD Signs (R1-1, 2)

STOP signs are intended for use on bicycle facilities where bicyclists are required to stop. Where conditions require bicyclists and not motorists to stop, care should be taken to place the sign so it is not readily visible to the motorist.

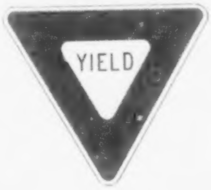
YIELD signs are intended for use where the bicyclist can see approaching traffic and where bicyclist must yield the right of way to that traffic. The visibility of approaching traffic must be adequate to permit the bicyclist to stop or to take other measures to avoid that traffic.

For added emphasis STOP and YIELD signs in regular 30 × 30-inch and 36 × 36 × 36-inch sizes may be used.

The smaller signs shown below are intended for use on bicycle trails where bicyclists are required to stop or yield the right of way. If the sign applies to motorists and bicyclists, then the size should be as shown in Part II-B.



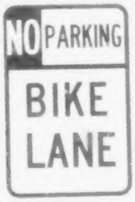
R1-1
18″ × 18″



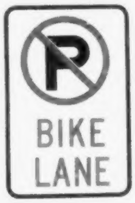
R1-2
24″ × 24″ × 24″

9B-11 No Parking Signs (R7-9, & 9a)

Where it is necessary to restrict parking, standing, or stopping in a designated bicycle lane, appropriate signs as described in sections 2B-31 through 2B-33 may be used, or signs R7-9 or R7-9a shall be used.



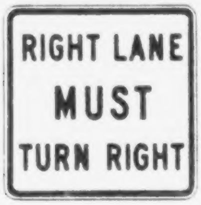
R7-9
12″ × 18″



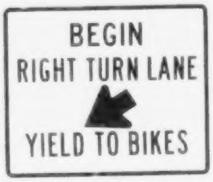
R7-9a
12″ × 18″

9B-12 Lane-Use Control Signs (R3-7, R4-4)

Where right turning motor vehicles must merge with bicycle traffic on designated bike lanes, the R3-7 and R4-4 signs may be used. The R4-4 sign is intended to inform both the motorist and the bicyclist of this merging maneuver. Where a designated bicycle lane is provided near the stop line, an R3-7 sign may be used to prevent motorists from crossing back over the bike lane.



R3-7
30" × 30"



R4-4
36" × 30"

9B-13 Warning Signs

Warning signs are used when it is deemed necessary to warn bicyclists or motorists of existing or potentially hazardous conditions on or adjacent to a highway or trail. The use of warning signs should be kept to a minimum because the unnecessary use of them to warn of conditions which are apparent tends to breed disrespect for all signs.

Warning signs specified herein cover most conditions that are likely to be met. If other warnings are needed, the signs shall be of standard shape and color for warning signs, and the legends shall be brief and easily understood.

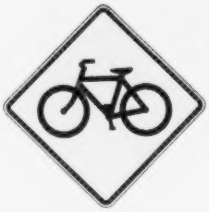
9B-14 Bicycle Crossing Sign (W11-1)

The Bicycle Crossing sign is intended for use on highways in advance of a point where a bikeway crosses the roadway. It should be erected about 750 feet in advance of the crossing location in rural areas where speeds are high, and at a distance of about 250 feet in urban residential or business areas, where speeds are low.

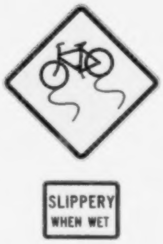
If the approach to an intersection is controlled by a traffic control signal, stop sign or yield sign, the W11-1 sign may not be needed.

9B-15 Hazardous Condition Sign (W8-10)

The Hazardous Condition sign is intended for use where roadway or bicycle trail conditions are likely to cause a bicyclist to lose control of his bicycle. These conditions could include slippery pavement, slick bridge



W11-1
30″ × 30″



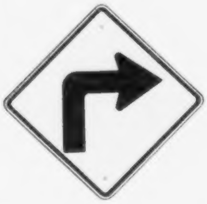
W8-10

Roadway Signs	Bicycle Trail Signs
30″ × 30″	18″ × 18″
24″ × 18″	12″ × 9″

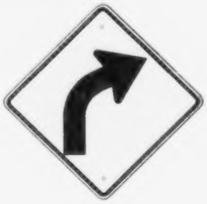
decking, rough or grooved pavement, or water or ice on the roadway. The W8-10 sign may be used with a supplemental plaque describing the particular roadway or bicycle trail feature which might be of danger to the bicyclist such as SLIPPERY WHEN WET, STEEL DECK, ROUGH PAVEMENT, BRIDGE JOINT, or FORD.

9B-16 Turn and Curve Signs (W1-1, 2, 4, 5, 6, 7)

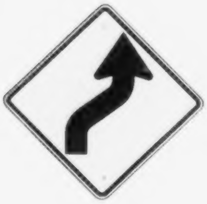
On bicycle trails where it is necessary to warn bicyclists of unexpected changes in path direction, appropriate turn or curve signs should be used. They should normally be installed no less than 50 feet in advance of the beginning of the change of alignment.



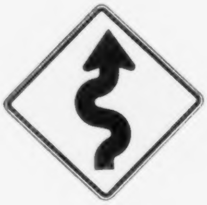
W1-1
18″ × 18″



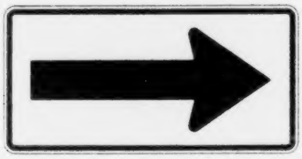
W1-2
18″ × 18″



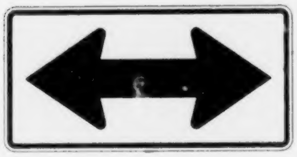
W1-4
18″ × 18″



W1-5
18″ × 18″



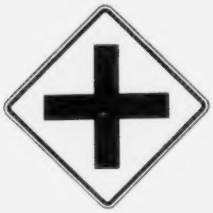
W1-6
24″ × 12″



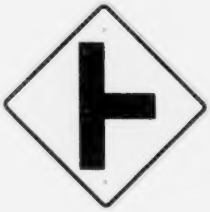
W1-7
24″ × 12″

9B-17 Intersection Signs (W2-1, 2, 3, 4, 5)

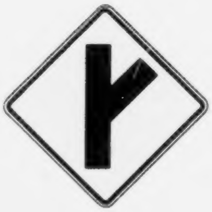
Intersection signs are intended for use as appropriate to fit the prevailing geometric pattern on bike trails where connecting routes join and where no STOP or YIELD signs are required. They should be used wherever sight distance at the intersection is severely limited, and may be used for supplemental warning at intersections where STOP and YIELD signs are erected.



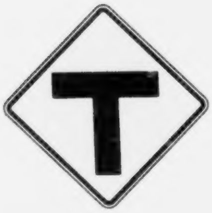
W2-1
18″ × 18″



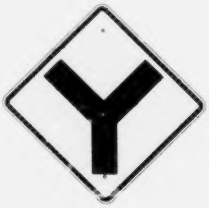
W2-2
18″ × 18″



W2-3
18″ × 18″



W2-4
18″ × 18″



W2-5
18″ × 18″

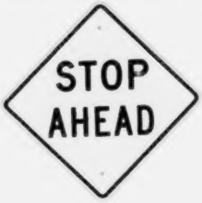
9B-18 Other Warning Signs

Other warning signs may be required on bicycle facilities to warn riders of unexpected conditions. The intended use of these signs generally is self-explanatory. They should normally be installed no less than 50 feet in advance of the beginning of hazards.

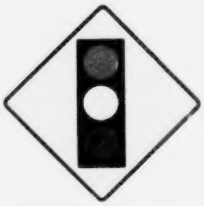
Where construction or maintenance activity is present on bicycle trails, appropriate signs from Part VI of the Manual should be used.

9B-19 Guide Signs

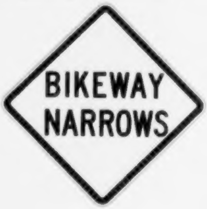
On highways where a bicyclist is sharing a lane with motor vehicles or is using an adjacent bikeway, the regular guide signing as described in Part II of this Manual will serve both modes of travel. Where a designated bikeway exists, special bicycle route signing should be



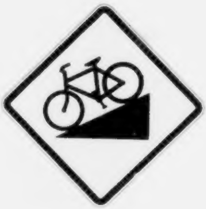
W3-1
18" x 18"



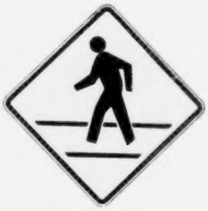
W3-3
18" x 18"



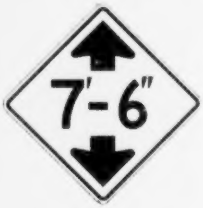
W5-4
18" x 18"



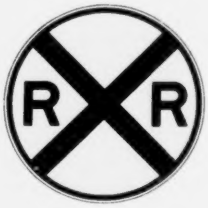
W7-5
18" x 18"



W11A-2
18" x 18"



W12-2
18" x 18"



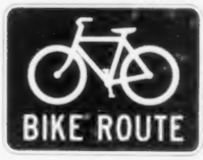
W10-1
18" Diameter

provided at decision points along the bikeway, including signs to inform cyclists of bicycle route direction changes and confirmatory signs to ensure that route direction has been accurately comprehended.

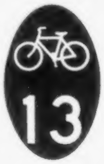
Figure 9–2 shows an example of the signing for the junction of a bicycle trail with a highway. Figure 9–3 shows the signing and marking for the beginning and ending of designated bikeways. Guide signing should be repeated at regular intervals to ensure that bicyclists approaching from side streets know they are traveling on an officially designated bikeway. Similar guide signing should be used for shared lane bikeways with intermediate signs placed frequently enough to ensure that cyclists already on the bikeway do not stray from it and lose their way.

9B–20 Bicycle Route Sign (D11–1)

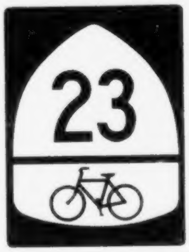
This sign is intended for use where no unique designation of routes is desired. It should be placed at intervals frequent enough to keep bicyclists informed of changes in route direction and to remind motorists of the presence of bicyclists.



D11-1
24" x 18"



M1-8
12" x 18"



M1-9
18" x 24"

9B–21 Bicycle Route Markers (M1–8, M1–9)

Where it is desired to establish a unique identification (route designation) for a State or local bicycle route, the standard Bike Route Marker (M1–8) should be used. The route marker (M1–8) shall contain a numerical designation and shall have a green background with a reflectorized white legend and border.

Where a bicycle route extends for long distances in two or more States, it is desirable to establish a unique numerical designation for that route. A coordinated submittal by the affected States for assignment of route number designations should be sent to the American Association of State Highway and Transportation Officials, 444 North Capitol Street NW., Suite 225, Washington, D.C. 20001. The route marker (M1–9) shall contain the assigned numerical designation and have a black legend and border with a reflectorized white background. IX-1 (c)

Bike Route Markers are intended for use on both shared facilities and on designated bikeways, as required, to provide guidance for bicyclists.

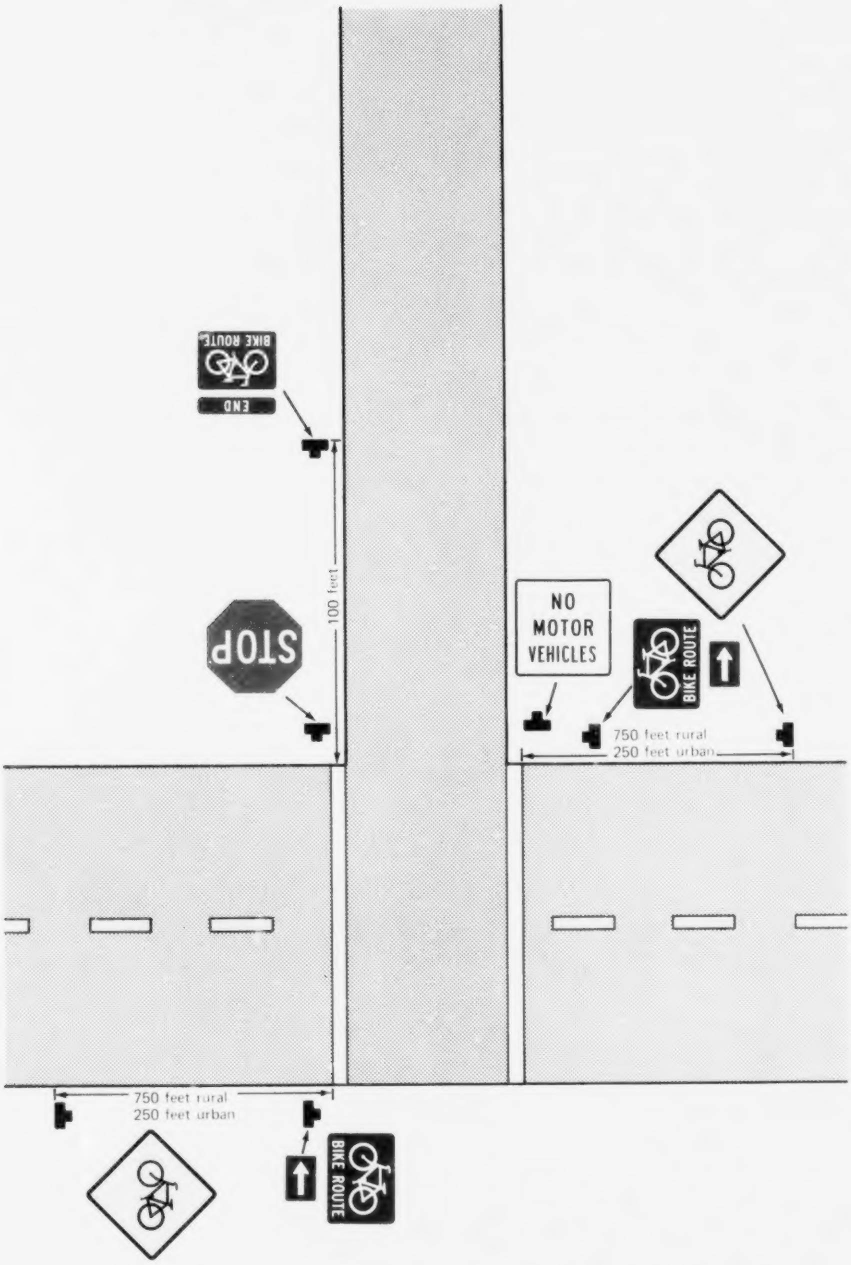
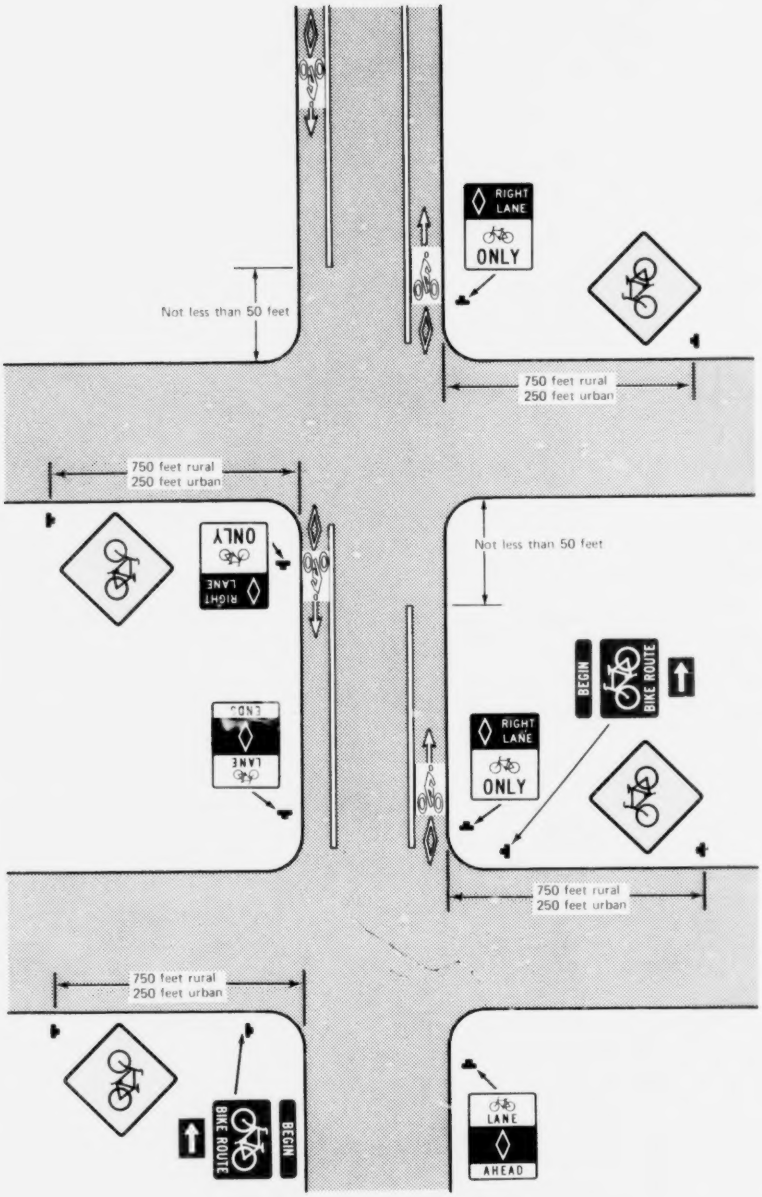

BIKE ROUTE
END
STOP
100 feet
NO MOTOR VEHICLES
BIKE ROUTE
750 feet rural
250 feet urban
750 feet rural
250 feet urban
BIKE ROUTE

Figure 9-2. Typical signing for beginning and ending of bicycle trail.

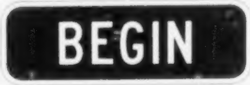


RIGHT LANE
ONLY
Not less than 50 feet
750 feet rural
250 feet urban
750 feet rural
250 feet urban
ONLY
RIGHT LANE
Not less than 50 feet
END
LANE
BEGIN
BIKE ROUTE
RIGHT LANE
ONLY
750 feet rural
250 feet urban
750 feet rural
250 feet urban
BIKE ROUTE
BEGIN
LANE
AHEAD

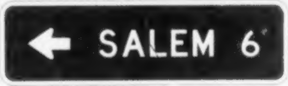
Figure 9-3. Typical signing for beginning and ending of designated bicycle lane.

9B-22 Supplemental Plaques for Route Signs and Route Markers

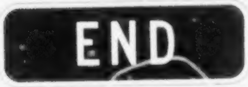
Where desired, supplemental plaques can be used with the D11-1 and M1-8 signs to furnish additional information, such as directional changes in the route, and intermediate range distance and destination information. The M4-11 through M4-13 signs may be mounted above the appropriate Route Signs or Route Marker. Supplemental plaques D1-1b and c are intended for use with the D11-1 Bicycle Route Sign. The appropriate arrow sign (M7-1 through M7-7), if used, should be placed below the Route Sign or Route Marker. These signs shall have a white arrow on a green background.



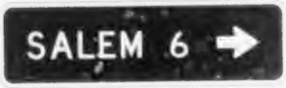
M4-11
24" × 6" or 12" × 4"



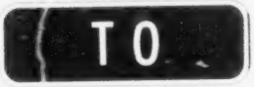
D1-1b(L)
24" × 6"



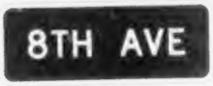
M4-12
24" × 6" or 12" × 4"



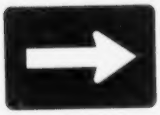
D1-1b(R)
24" × 6"



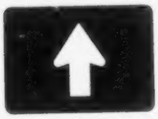
M4-13
24" × 6" or 12" × 4"



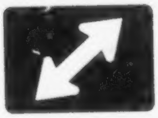
D1-1(c)
24" × 6"



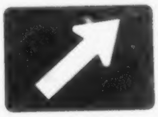
M7-1



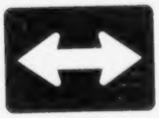
M7-2



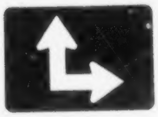
M7-3



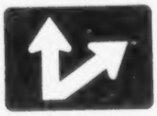
M7-4



M7-5



M7-6

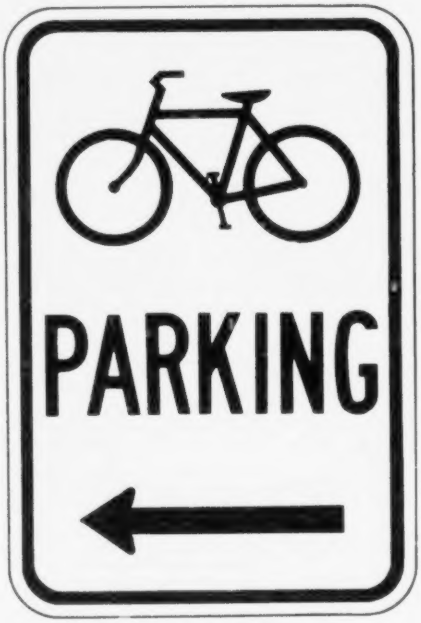


M7-7

M7-1 through M7-7
12" × 9"

9B-23 Bicycle Parking Area Sign (D4-3)

The Bicycle Parking Area sign may be used where it is desired to show the direction to a designated bicycle parking area within a parking facility or at other locations. The sign shall be a vertical rectangle of a standard size of 12 by 18 inches. It shall carry a standard bicycle symbol, the word PARKING, and an arrow. The legend and border shall be green on a reflectorized white background. IX-2 (c)



D4-3
12″×18″

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C. MARKINGS

9C-1 Functions and Limitations of Markings

Markings are important on roadways that have a designated bicycle lane. Markings indicate the separation of the lanes for motor vehicle and bicycles, assist the bicyclist by indicating assigned travel paths, and can provide advance information for turning and crossing maneuvers.

9C-2 General Principles

Although bicycles are generally not equipped with strong lighting equipment, the added visibility of reflectorized pavement markings is desirable even where there is exclusive use by bicyclists.

Markings shall be reflectorized on bicycle trails and on facilities used by both motor vehicles and bicycles.

Recognized bikeway design guides should be used when laying out markings for a bicycle lane on a highway facility (sec. 9A-8).

The frequent use of symbols and word messages stenciled in the bike lanes, is a desirable method of supplementing sign messages. Figures 9-4 through 9-6, show acceptable examples of the application of lines, word messages and symbols on designated bikeways with and without parking for motor vehicles.

If a specific path for a bicylist crossing an intersection is to be designated, a dotted line may be used to define such a path.

9C-3 Marking Patterns and Colors

The color and type of lines used for marking bicycle facilities shall be as defined in section 3A-7. Normally, center lines would not be required on bicycle paths. Where conditions make it desirable to separate two directions of travel at particular locations, a double solid yellow line should be used to indicate no passing or no traveling to the left of the line.

Where bicycle paths are of sufficient width to designate two minimum width lanes, a broken yellow line may be used to separate the two directions of travel.

Broken lines used on bicycle paths should have the normal 1 to 3 segment-to-gap ratio. To avoid having gaps excessively long, a nominal 3-foot segment with a 9-foot gap is recommended.

Where bicycles and pedestrians use a common facility, it may be desired to separate the two traffic flows. A solid white line should be used to mark this separation of path use. The R9-7 sign may be used to supplement the pavement marking (sec. 9B-9).

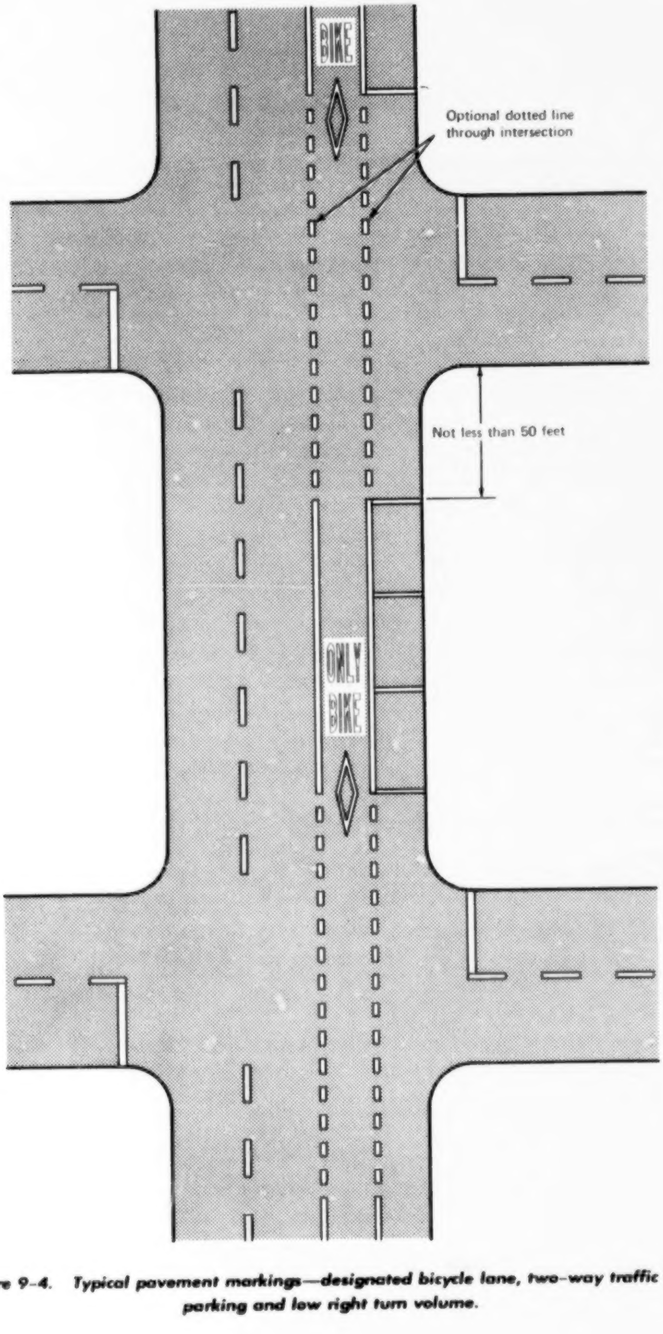

BIKE
Optional dotted line through intersection
Not less than 50 feet
ONLY
BIKE

Figure 9–4. Typical pavement markings—designated bicycle lane, two-way traffic with parking and low right turn volume.

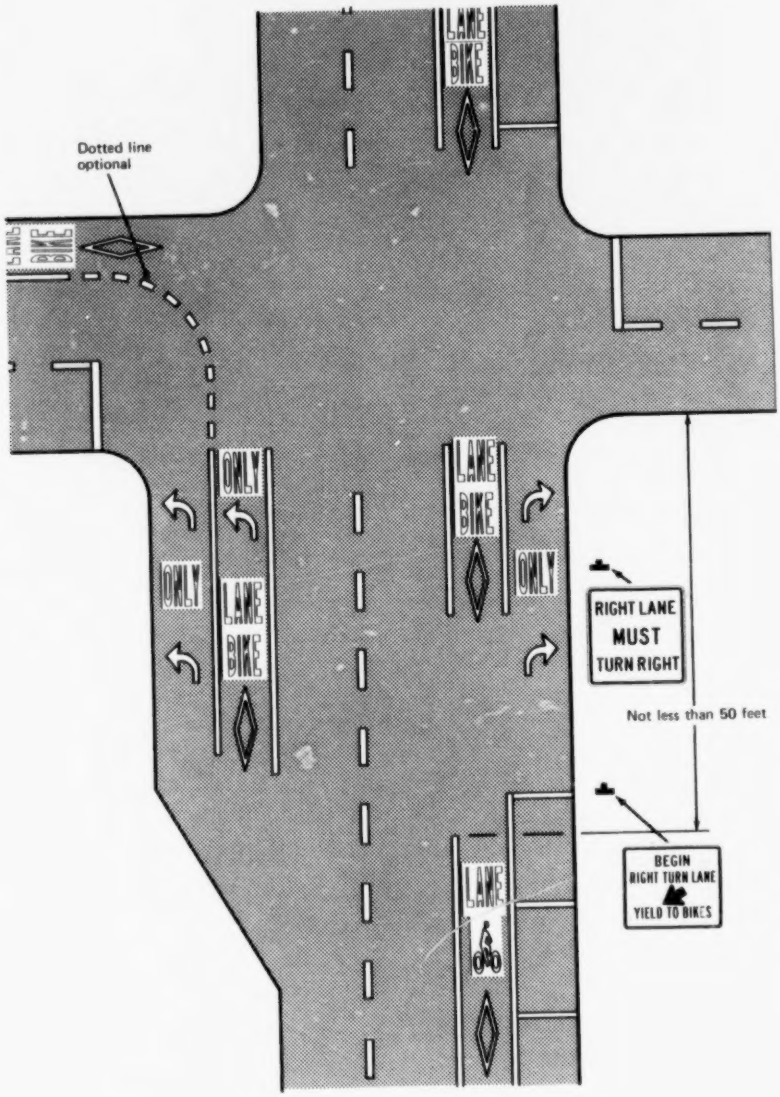

Dotted line optional
LANE
BIKE
BIKE
LANE
ONLY
ONLY
LANE
BIKE
LANE
BIKE
ONLY
ONLY
RIGHT LANE
MUST
TURN RIGHT
Not less than 50 feet
BEGIN
RIGHT TURN LANE
YIELD TO BIKES
LANE

Figure 9–5. Intersection pavement markings—designated bicycle lane with left turn area, heavy turn volumes, parking, one-way traffic or divided roadway.

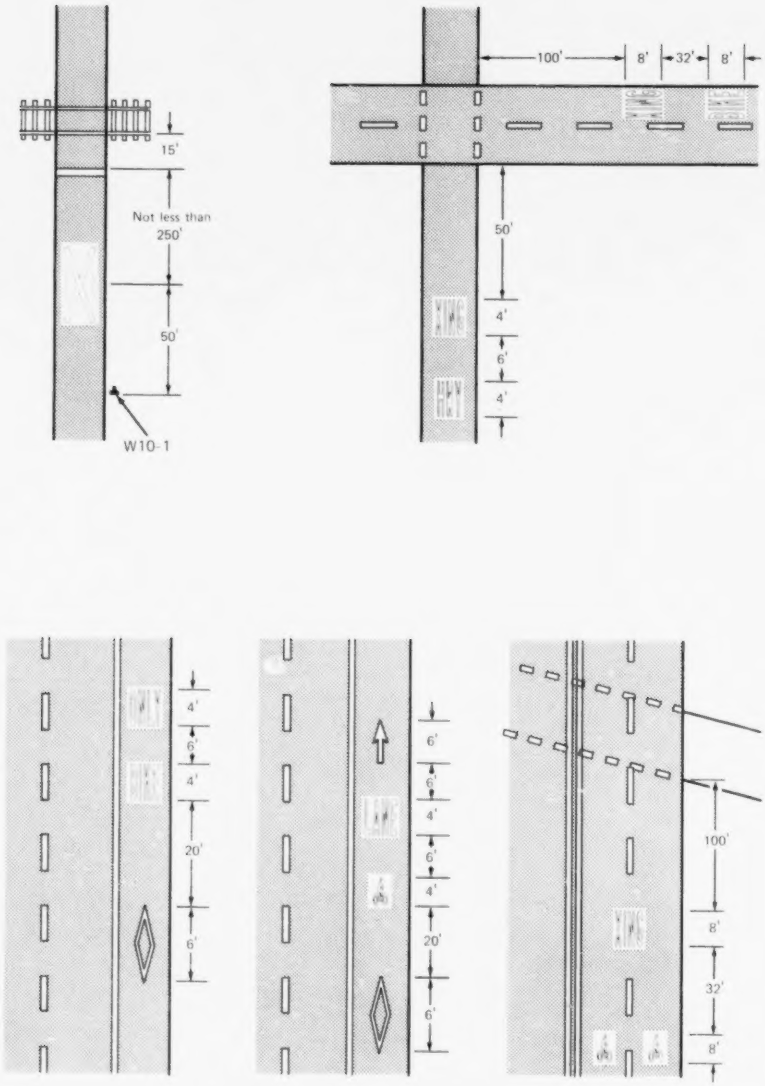

15'
Not less than 250'
50'
W10-1
100'
8'
32'
8'
50'
XING
4'
6'
BIKE
4'
ONLY
4'
6'
BIKE
4'
20'
6'
6'
6'
LANE
4'
6'
4'
20'
6'
100'
XING
8'
32'
8'

Figure 9-6. Word and symbol pavement markings for bicycle facilities.

9C-4 Marking of Designated Bikeways

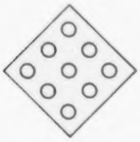
The diamond-shaped Preferential Lane Symbol is intended for use on highway facilities where lanes are reserved for exclusive use by a particular class of vehicle. Designated bikeways are considered as this type of lane and shall include use of the Preferential Lane Symbol as a pavement marking and on appropriate signing (sec. 9B-8). The symbols as a pavement marking shall be white and shall be used immediately after an intersection to inform motorists turning of the restricted nature of the lane. If the Preferential Lane Symbol is used in conjunction with other word or symbol messages, it shall precede them. A supplemental lane symbol or word may be used following as shown in figures 9-4 through 9-6.

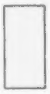
9C-5 Word Messages and Symbols Applied to the Pavement

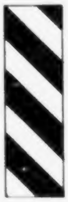
Where messages are to be applied on the pavement, smaller size letters can be used on exclusive bike lanes than are used on regular highways. Where arrows are needed, half-size layouts of the arrows can be used (sec. 3B-17). Optional word and symbol markings considered appropriate for use with the Preferential Lane Symbol marking are shown in figure 9-6. Standard pavement marking alphabets and symbols have been prepared.*

9C-6 Object Markings on Bicycle Trails

There may be hazardous objects located adjacent to bicycle trails which, if visible to the rider, can be avoided with little difficulty. Such objects can be marked with highly visible markings to make their identification by approaching riders more certain. Care should be taken to avoid having object markers become hazardous objects. Corners of object markers as well as signs should be rounded to prevent their becom-


Type I
18" × 18"


Type II
6" × 12"


Type III
12" × 36"

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* Available from the Federal Highway Administration (HTO 20) Washington, D.C. 20590

ing a hazard. All object markers should be designed using reflective materials or coatings. Where practical, markers such as those described in section 3C-1 of this Manual should be used.

Where a storm drain hazard cannot be eliminated, it may be made more visible to bicyclists by defining with a white marking applied as shown in figure 9-7.

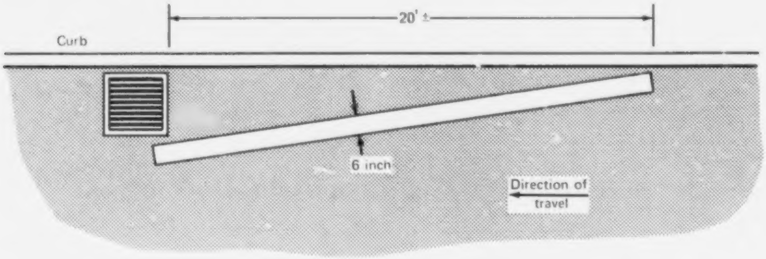

Figure 9-7. Typical marking in advance of drainage hazard.

D. SIGNALS

9D-1 Application

It is rare when a traffic signal is installed solely for bicyclists; however, at some locations there may be a need to install signal devices to facilitate bicycle travel through the intersection. For warrants and other requirements relating to signal installations, see Part IV of this Manual. Warrants used for motor vehicles are considered appropriate for use in determining the need for signals to serve bicyclists. Warrant Four for school crossings is considered to be appropriate for bicyclists also.

9D-2 Visibility Requirements

At installations where programmed signals are used, special attention should be given to adjusting the signals so bicyclists on the regular bicycle lanes or travel paths can see the signals. If programmed signals cannot be aimed to serve the bicyclist, then separate signals shall be provided.

9D-3 Signal Operation for Bicycles

Bicycles generally can cross intersections under the same signal timing arrangement as motor vehicles. Where bicycle use is expected, extremely short change intervals should not be used and an all red clearance interval may be necessary.

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GENERAL PROVISION

Number	Title/Section	Ruling	Effective Date
I-1(Chng.)	Legal Authority	Request withdrawn as it involved no substantive change in the MUTCD. The requirement that traffic control devices be placed only under the authority of a public body or official having jurisdiction appeared in Parts II, V, VII, and IX. Although intended that authority for the placement of all traffic control devices be required, no specific reference was included in Parts III, IV, VI and VIII. As an editorial change a consolidated "Placement Authority" Section (1A-3.1) is added in Part I and Sections 2A-3, 5A-2, 7A-8, and 9A-6 are revised to refer to Section 1A-3.1 for "Placement Authority".	1/10/83
I-2(Intr.)	Definition of the Term "Roadway" 1A-9	Unless specifically stated, the term "roadway" within the MUTCD is the same as defined in the Uniform Vehicle Code and the 1971 edition of the MUTCD. The definition of the term "roadway" is added as an editorial change.	12/6/83

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SIGNS

Number	Title/Section	Ruling	Effective Date
II-1(Chng.)	Specific Service Signs Deletes Sec. 2F-34 Establishes New Sec. 2G to 2J	Adopts with some modification and transfers to the MUTCD the National Standards for Specific Information Signs. These standards currently exist in 23 CFR Part 655, Subpart C and the Federal-Aid Highway Program Manual, Volume 6, Chapter 8, Section 3, Subsection 8.	7/22/85
II-2(Chng.)	Diesel Fuel Sign 2D-46,2F-33, 2F-34	Approved the addition to the MUTCD which will provide for the display of diesel fuel in general motorist service signing. A new symbol sign was also approved.	4/2/78
II-3(Expr.)	Overload Symbol Sign	Symbol Sign to emphasize restricted loading contained too much detail and had vague message. Evaluation of such a sign would be difficult to assess. The request was not approved.	8/4/78
II-4(Chng.)	Placement of Warning Signs 2C-3	As an aid that should be used with engineering judgement, provides more specific guidance on the placement of warning signs; relating the prevailing speed and conditions of warning sign placement.	2/9/83
II-6(Chng.)	Signing for Restrooms at Rest Areas 2D-42, 2F-35	Standardized rest area sign to inform approaching motorists of the availability of restrooms was approved.	9/28/78
II-7(Chng.)	Signing Public Median Crossovers 2D-52	A new section is added to provide more specific guidance on standard signs for inconspicuous public crossovers.	3/1/84
II-8(Chng.)	Ramp Terminal Destination Signs 2D-35	The three destination limit on ramp signing has been modified to permit four destinations on ramp signing when four destinations are included on the main line.	9/26/78

Number	Title/Section	Ruling	Effective Date
II-9(Chng.)	Turn Sign Usage Criteria	This request to delete references to speed when determining whether to use a curve or turn sign was denied. Requester proposed that the arrow should more closely resemble the roadway alignment rather than to indicate the severity of curve.	9/21/78
II-10(Chng.)	Signing at Signalized Intersections 2B-15, 2B-29	Provides clarification of sign placement at signalized intersections.	3/1/84
II-11(Chng.)	Added Lane Symbol Sign 2C-18, 2C-18.1	A symbol sign was approved that informs motorists on main roadway as well as those on the ramp that a merging maneuver is not necessary.	7/19/78
II-12(Chng.)	Channel 9 Monitored Sign 2D-46, 2F-37	Standardized the sign used to inform motorists that the citizen band emergency channel is being monitored by an official government agency or its designee. Compliance Date 2/9/88.	2/9/83
II-13(Intr.)	Signing for Regional Shopping Centers	Signing for destinations such as regional shopping centers on the Interstate System or other freeways is not in keeping with National MUTCD standard signing principles for such highways.	8/17/78
II-14(Expr.)	Symbolic No Right (Left) Turn on Red	Approval was given to experiment with a sign depicting the Right (Left) Turn prohibition symbol along with the words on RED.	12/18/78
II-15(Expr.)	Special Merge Sign	A warning sign indicating MERGE with a downward sloping arrow on a trapezoid for use in a special case of a left-hand on-ramp merge situation was not approved for experimentation.	8/10/78
II-16(Chng.)	Accessibility to Handicapped Persons for Logo Businesses	A request to establish accessibility to handicapped persons as a criteria for logo signing (motels, restaurants, etc.) was not approved as establishing such criteria for the logo signing program is a State legal matter and the MUTCD requirements cover design of the sign to be used as needed.	2/9/83

Number	Title/Section	Ruling	Effective Date
II-17(Expr.)	Sign Legend for Tourist Information Centers	Experimentation approved to determine if there is a detrimental effect in using the term TOURIST as opposed to TRAVELER in conjunction with information centers.	10/31/78
II-18(Chng.)	Use of Terms Parking, Standing Stopping	A request to add clarifying language on the terms "Parking", "Standing", and "Stopping", each being a progressively more restrictive prohibition, so only one of the three terms need be used on a Parking Prohibition sign was not approved for the following reasons: (1) the MUTCD already permits the use of individual messages on a particular sign; (2) the example in the MUTCD has been modified to illustrate only one of the terms on the sign; and (3) engineers should have the prerogative to use two or three of the terms on a single sign to provide emphasis.	2/9/83
II-19(Chng.)	Spacing of Chevron Alignment Signs	A request to include a suggested spacing for Chevron Alignment Signs was not approved for the following reasons: (1) this sign should be used for added emphasis to denote the sharpness of a road curve and because of its use in special situations, there must be some flexibility in spacing; and (2) field observations have found that the present MUTCD spacing guide is adequate.	2/9/83

Number	Title/Section	Ruling	Effective Date
II-20(Chng.)	Symbol for Police Assistance 2D-46	Standardizes the sign used for police assistance.	3/1/84
II-21(Chng.)	Motorcycle and/or Trail Bike Symbol	A request for a uniform motorcycle symbol was not approved for the following reasons: (1) the National Park Service (NPS) has a symbol for motorcycles which is being used nationally; and (2) the NPS symbols are included in the MUTCD by reference.	2/9/83
II-22(Cnng.)	Noise Ordinance Sign	A request for adoption of a national standard for a Noise Ordinance sign was not approved for the following reasons: (1) the Noise Ordinance sign is not an appropriate traffic control device; (2) such a sign is a notification of a blanket regulation and as such is permitted where specific ordinances are enforced; and (3) the general nature of the sign does not identify the noise level limit.	2/9/83

Number	Title/Section	Ruling	Effective Date
II-23(Chng.)	Signing for Bypass Lanes	A request for adoption of a national standard for signing bypass lanes was not approved for the following reasons: (1) any paved surface that is improved, designed or ordinarily used for vehicular travel to the right of left turning vehicles may be used by vehicles to bypass the turning vehicles; (2) the extent of bypass lane use across the country does not appear to warrant the establishment of a national standard at this time; (3) several government agencies which have used bypass lanes without special signs have indicated no operational problems; and (4) a bypass lane constructed to relatively high geometric standards would likely cost only slightly less than a design that would provide for a left turn lane.	2/9/83
II-24(Chng.)	Modified Parking Area Sign	A request for adoption of an additional parking sign consisting of white legend and arrow, and a white and green automobile symbol on a brown background was not approved for following reasons: (1) the color brown is reserved for use to denote recreational and cultural interest guidance; (2) the proposed sign provides no improvement over the existing standard parking sign; (3) it would be difficult to discern the message with the color combinations proposed.	2/9/83
II-25(Expr.)	Overhead Guide Signs	Experimentation approved to evaluate the effectiveness of nonilluminated opaque background overhead guide sign having reflectorized legend and border. Experimentation completed 4/7/81. Non-Illuminated-Opaque Background Overhead Signs proposed as item II-57(Chng.).	5/21/79

Number	Title/Section	Ruling	Effective Date
II-26(Chng.)	Application of Advance Street Name Signs 2D-39	Permits the installation of advance street signs below an intersection related warning sign on intersection approaches, eliminating the need for independent sign supports.	2//9/83
II-27(Chng.)	Prioritized Listing of Basic Sign Groups 2A-4	Provides guidance for establishing the priority of sign placement in areas where the number of signs that may practically be installed is limited.	2/9/83
II-28(Chng.)	911 Emergencv Sign	A request to adopt a standard sign to inform the public of the emergency assistance telephone number 911 was not approved for the following reasons: (1) since a motorist-seeking aid would have to locate a telephone, the information on emergency assistance could be provided at the telephone; and (2) such signs would detract from essential highway information.	2/9/83
II-29(Chng.)	Application of Winding Road Sign 2C-8	Permits the use of the Winding Road Sign (W1-5) to warn of a series of three or more curves in lieu of installing a series of Reverse Curve or Reverse Turn signs.	2/9/83
II-30(Intr.)	Modification of Letter and Numeral Sizes for Substandard Freeways 2F-11	Letters and numerals used on linear parkway guide signs in either urban or rural areas are those specified in Table II-2. In unique and exceptional circumstances waiver of the letter and numeral size requirements of Table II-2 for specified linear parkways may be granted on a section by section basis.	7/2/81

Number	Title/Section	Ruling	Effective Date
II-31(Chng.)	Signing for Left Turns Protected on Arrow Signals	provides a standard sign for use at protected/permitted signalized left turns. A 5-year period for compliance is provided. COMPLIANCE DATE 3/1/89.	3/1/84
II-32(Intr.)	Use of School Advance Sign and School Speed Limit Sign at Specific Locations	The S4-3 SCHOOL panel is the proper panel to use with the School Speed Limit sign assembly since the use of the Advance School sign would effect an excessive increase in the height of the assembly. This does not preclude the permissive use of the S4-3 SCHOOL panel and S1-1 School Advance sign in the same general area.	7/2/81
II-34(Expr.)	High Accident Area Signs	Approval was given to experiment with a series of signs to alert motorists to sections of roadway with a high number of accidents.	5/25/79
II-35(Intr.)	High Visibility Yellow Traffic Posts	High visibility yellow and other colors are acceptable for small signs supports provided these colors are NOT reflectorized. Color coding of small sign supports is not recommended. The predominant color of delineation reflective units is white or yellow. The mixing of these two predominant colors on a delineator assembly might create confusion to the motorist. Therefore, it is inappropriate to mix these two colors on a delineator assembly.	7/2/81
II-36(Chng.)	Advance Rest Area Signs 2E-38, 2F-35	Allows the installation of signs with information on the location of succeeding rest areas.	2/9/83
II-38(Chng.)	Identifying Left-Hand Exit on Interchange Sequence Signs 2E-34	Provides a method of identifying left-hand exists on Interchange Sequence signs for urban freeways.	3/1/84

Number	Title/Section	Ruling	Effective Date
II-39(Chng.)	Dead End Signs on Intersecting Streets	A request for the development of a standard sign to advise motorists of an intersecting street that dead ends was not approved for the following reasons: (1) existing signs are adequate and can be located such that a motorist on an intersecting street can see these signs before a turn is made into the dead end street; and (2) it would lead to sign proliferation.	2/9/83
II-40(Intr.)	Use of Light Blue Auxiliary Panels on Appalachian Highway	The use of the legend APPALACHIAN HIGHWAY in white on a light blue background auxiliary panel to supplement the standard black and white route markers for those highways forming the Appalachian Development Highway system was approved as a unique situation which does not have general application. This is applicable solely to the Appalachian Development Highway System. The white on light blue auxiliary panels will not be permitted for use on junction assemblies on crossroad approaches to the Appalachian Development Highways.	7/2/81
II-41(Chng.)	Grooved Pavement Sign	A request to require the use of a GROOVED PAVEMENT advance warning sign was not approved. Use of this sign remains optional.	2/9/83
II-42(Chng.)	Use of the Color Coral for Mass Transit	A request that the color coral be used for the background of mass transit and park-and-ride facility signs was not approved for the following reasons: (1) mass transit and park-and-ride signs do not represent a sufficiently major group of signs to warrant classification as a unique category of signs; (2) there is insufficient justification for use of a special color; and (3) new standard signing for park-and-ride facilities permits the use of the carpool symbol and bus logo, which provide ready recognition.	2/9/83

Number	Title/Section	Ruling	Effective Date
II-43(Chng.)	Anti-Litter Symbol Sign	A request to adopt a national symbol to discourage motorists from littering highways and national parks was not approved for the following reasons: (1) the existing standard signs are sufficient for the needs; and (2) stricter enforcement of State and local statutes would appear to have far greater potential for reducing the litter problem.	2/9/83
II-44(Chng.)	Addition of Language for Handicapped Parking Sign	A request to adopt a supplemental plate with the legend BY TAG, PERMIT ONLY, or equivalent was not approved as there is a wide variety of regulations governing parking for handicapped persons throughout the country and the MUTCD already permits the use of supplemental plates to accomplish the desired result.	2/9/83
II-45(Chng.)	School Trip Safety 2B-13, 7B-12, 7E-5, 7E-11	In school areas, the END SCHOOL ZONE sign may be used as an alternate to the Speed Limit sign. Emphasizes the need for protective clothing and devices for school crossing guards and patrols. A 5-year period for compliance is provided. COMPLIANCE DATE 3/1/89.	3/1/84
II-46(Chng.)	Emergency Medical Services (EMS) Symbol 2D-46	Provides for the "Star of Life" design as the standard symbol for signs providing information for access to the EMS system.	3/1/84
II-47(Intr.)	Number of Mandatory Advance Guide Signs	Each major and intermediate interchange is required to have an exit direction sign and from one to four advance guide signs depending on interchange spacing, design, and traffic conditions. This does not include any duplicate signs placed on the left side of the roadway or interchange sequence series signs. since gore signs are not classified as interchange guide signs, they are not included in minimum or maximum requirements.	7/2/81
II-48(Chng.)	Application of Warrants for STOP Signs 2B-5	Provides additional emphasis on the need to consider less restrictive traffic control measures prior to the installation of STOP signs.	3/1/84

Number	Title/Section	Ruling	Effective Date
II-49(Expr.)	Symbolic Pedestrian Push Button Sign	Approval was given to experiment with a proposed symbolic pedestrian push button sign to determine pedestrian behavior. Experimentation completed 7/21/80, sign proposed as item II-55(Chng.)	3/24/80
II-50(Chng.)	Mandatory Use of No Passing Zone Pennant sign (W14-3)	Based upon a user survey, literature review and comments received from Docket No. 80-10, this request is denied.	7/22/85
II-51(Chng.)	Additional Warrants for Multiway STOP Signs	A request for a warrant based on a combination of traffic volume and minimum sight distance at an intersection was not approved as the proposal would promote the excessive use of STOP signs, unnecessarily disrupt traffic flow and contribute to the waste of fuel.	2/9/83
II-52(Chng.)	Beginning of Pavement Width Transition Sign	A request to include a standard warning sign to mark the physical beginning point of a pavement width transition was not approved as there appears to be no significant problem in pavement width transition signing and the present signing provided in the MUTCD is adequate.	2/9/83
II-53(Chng.)	Mandatory Movement Sign	A request to provide standard signs for mandatory turning movement at intersections was not approved as they can be adequately signed under the present provisions of the MUTCD.	2/9/83
II-54(Chng.)	Add Percent Grade Within Hill Sign 2C-26	Permits the display of the percent of grade within the Hill sign (W7-1).	3/1/84
II-55(Chng.)	Symbolic PUSH BUTTON FOR WALK SIGNAL Sign 2B-37	Adopts a symbol sign to be used as an alternate to the standard MUTCD word message regulatory sign (R10-4).	12/31/84
II-58(Chng.)	Median Mounted One-Way Signs 2A-31, 2B-29	Provides more specific guidance on the placement of one-way signs at intersections with divided highways. A 5-year period for compliance is provided. COMPLIANCE DATE 3/1/89.	3/1/84
II-59(Chng.)	Temporary Attention Getting Devices	A request to provide for the optional and temporary use of three devices (a sign, flags, or panel) to draw motorist's attention to newly installed traffic controls was not approved as the MUTCD already provides satisfactory means including the use of flags, for attention-getting.	2/9/83

Number	Title/Section	Ruling	Effective Date
II-62(Chng.)	Alternate NEXT RIGHT Legend for 1/2 Mile Advance Guide Signs	A request to permit the legend NEXT RIGHT (NEXT LEFT) on advance guide signs located 1/4 to 1/2 mile from an exit at major and intermediate interchanges was not approved. The required mileage action message provides superior guidance and the date for compliance, December 31, 1990, provides more than ample time to revise the sign message through normal, routine maintenance at minimum cost.	2/9/83
II-63(Chng.)	Use of Chevron Alignment Sign on Conventional Roads 2C-10	Provides for the use of the Chevron Alignment sign as an alternate to standard delineation treatments.	3/1/84
II-64(Chng.)	Symbol Sign for NOAA Weather Information	A request to include a symbol sign to identify rest areas having receivers of National Oceanic and Atmospheric Administration (NOAA) Weather Broadcasts was not approved as the proposed symbol does not communicate the intended message as well as the word legend WEATHER INFO already permitted by the MUTCD.	2/9/83
II-65(Chng.)	Service Signing for Liquified Petroleum Gas 2D-46	Establishes a standard symbol for identifying LP-Gas refilling facilities for those highway agencies wishing to identify such facilities.	7/22/85
II-66(Chng.)	Lane Drop Symbol Sign 2F-25	This request to adopt a standard lane drop symbol was not approved.	7/22/85
II-69(Expr.)	Criteria for Gas Logo Signing	Approval was given to experiment with the criteria for the Gas Logo for Specific Service Information Signs.	12/23/81
II-71(Chng.)	Narrow Bridge Symbol Sign 2C-21	This request to revise the Narrow Bridge Symbol Sign (W5-2a) was not approved.	7/22/85
II-72(Expr.)	Advisory Speed Sign for GSRS (Grade Severity Rating System)	Approval was given to experiment with a sign to advise trucks of various gross weights of the maximum speed(s) on steep downgrades.	5/7/82
II-73(Chng.)	Signing and Marking Structures with Substandard Vertical Clearance 2C-34	Section 2C-34 provides adequate information for signing and locating vertical clearance signs. Therefore, this request to add more specific information was not approved.	7/22/85

Number	Title/Section	Ruling	Effective Date
II-75(Chng.)	Sign Requirements for Two Way Left Turn Only Lanes 2B-19, 3B-12	This amendment revises Sections 2B-19 and 3B-12 to relax the present mandatory requirements while maintaining adequate means to inform the public of two way left turn lane operations.	12/31/84
II-76(Chng.)	Supplemental Guide Signs for Traffic Generators Adjacent to Freeways 1A-7, 2E-28	This request to reference the American Association of State Highway and Transportation Officials' (AASHTO's) "Guidelines for the Selection of Supplemental Guide Signs for Traffic Generators Adjacent to Freeways" is adopted. In conjunction with this change the FHWA has relaxed the recommendations of MUTCD Section 2E-28 for States to develop their own supplemental signing policy and the requirement for installation of supplemental guide signs as an independent assembly.	7/22/85
II-77(Chng.)	Guidelines for Selection of Control Cities 1A-7, 2F-7	The AASHTO publication, "List of Control Cities for Use in Guide Signs on Interstate Highways" has been incorporated by reference in the MUTCD. This change provides better control city selection criteria.	7/22/85
II-78(Chng.)	Library Symbol Sign 2D-49	Because of its widespread use and support, the American Library Association's (ALA) library symbol sign is adopted as a General Information Sign (I-Series) which must be white on green.	7/22/85
II-79(Expr.)	Use of Strong Yellow-Green for Emergency Situations	Approval was given to experiment with strong yellow-green as the background color for emergency signs.	2/18/83
II-81(Chng.)	Symbol for CB Emergency Channel 2D-46, 2F-37	The national standard sign which contains the name of the monitoring agency and the words MONITORS CB CHANNEL 9 continues to perform satisfactorily. Therefore, this request was not adopted.	7/22/85

Number	Title/Section	Ruling	Effective Date
II-82(Intr.)	Positioning of Overhead Lane-Use Control Signs 2B-17, 2B-18	Lane-use control signs are not designed for, nor are they intended for use adjacent to a signal face. Such use could lead to unnecessary motorists confusion. When the MUTCD refers to overhead positioning of Lane-Use Control signs it means directly above and normally at the beginning of the lane to which it applies, not across the intersection. Lane-Use Control signs shall be used whenever it is desired to require vehicles in certain lanes to turn, or to permit turns from an adjacent lane, except where turning bays, designed so as to not entrap through traffic, are provided and only the auxiliary lane is permitted to turn.	10/31/83
II-87(Intr.)	Shape of Route Shield on Guide Signs 2D-11, 2E-20, 2F-40	Where route markers are used as components of guide signs the marker (shield) outline should appear against a background of guide sign face material. The marker (shield) panel can be shaped to the outline of the shield and applied to the guide sign face or the shield may be applied on a square panel for mounting on the guide sign so long as the panel face, outside the shield outline is covered with guide sign face material.	3/1/84
II-88(Intr.)	Standard Symbol Sign for Horse-Drawn Vehicle	The Michigan Department of Transportation suggested there may be a need for a national symbol sign to warn motorists of horse-drawn vehicles. The FHWA has concluded that a national standard is not required. However, FHWA does not object to any State which chooses to adopt this symbol sign as their standard.	3/1/84

Number	Title/Section	Ruling	Effective Date
II-91(Intr.)	Application of Lane Use Control Signs at Intersections 2B-18	The city of Kennewick, Washington, submitted a request to add the words "separate turning lane" to the last sentence of the first and last paragraphs of Section 2B-18. Regarding the last sentence of paragraph 1, the FHWA interprets the term turning bays to be synonymous with separate turning lanes. Therefore, there is no need for change in the MUTCD. This also is the case in the suggested last sentence for paragraph 4. FHWA interprets the term mandatory turn lanes to include separate turn lanes. In addition to the above suggestion, the city of Kennewick also commented that regarding paragraph 4, the prevalent practice is to install pavement markings where turn lanes exist. They feel signs are seldom used. The FHWA believes very strongly that mandatory movement signs must be used with all mandatory turn lanes regardless of whether or not pavement markings are used. Pavement markings are often covered by vehicles, debris, or snow. Therefore, they are not considered totally acceptable from a safety standpoint nor can they be substituted for regulatory signs for enforcement purposes.	8/20/84
II-95(Expr.)	Diagrammatic Signs on I-35 and I-635 2F-24	Approval was given to experiment with the use of three destinations (vs. two destinations) for a diagrammatic sign on the interchange of I-35 and I-635 in Kansas City, Missouri.	4/19/84
II-96(Expr.)	Diagrammatic Signs on I-70 and I-635 2F-24	Approval was given to experiment with the use of three destinations (vs. two destinations) for a diagrammatic sign on the interchange of I-70 and I-635 in Kansas City, Missouri.	9/25/84
II-97(Intr.)	Advisory Weight Limit Signing 2B-41	The Michigan Department of Transportation requested consideration be given to amend Section 2B-41 of the MUTCD to allow a second advance weight limit sign to be placed at the nearest intersecting road at which a vehicle can detour or turn around. The FHWA agrees with this practical application and appropriate language has been added to this section of the MUTCD.	6/29/84

Number	Title/Section	Ruling	Effective Date
II-100(Expr.)	Right Turn Permitted Without Stopping	The purpose of this approved experimental project is to establish guidelines for the installation of "Right Turn Permitted Without Stopping" signing and to collect accident and operating statistics on this type of intersection control.	1/9/85
II-105(Expr.)	Color Coded Emergency Detour Signing	Approval was given to experiment with the use of color coded detour arrows to mark designated emergency detour routes.	8/16/85
II-111(Expr.)	Specific Services Information via Highway Advisory Radio (LOGO HAR)	Approval was given to experiment with the use of Highway Advisory Radio (HAR) to inform motorists of specific motorist services at an interchange. This experiment would compare the costs and effectiveness of the HAR installation with the conventional means of conveying this type of information via logo signs.	8/9/85

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MARKINGS

Number	Title/Section	Ruling	Effective Date
III-1(Expr.)	Use of Single Solid Yellow Centerline in Urban Areas to Restrict But Not Prohibit Crossing	Approval was given to experiment with the use of a single solid yellow centerline in urban areas to restrict but not prohibit crossing. Experimentation completed and terminated.	8/10/73 2/14/80
III-4(Chng.)	Reduced Eye Height Dimensions from 3.75 feet to 3.50 feet 3B-5	Reduces the eye height/object height to 3.50 feet to accommodate the influx of smaller cars in the passenger vehicle fleet. A 5-year period for compliance is provided. COMPLIANCE DATE 3/1/89.	3/1/84
III-6(Chng.)	Edgeline Requirements for Rural Highway 3B-6	Requires the use of edgelines on all rural multilane divided highways. COMPLIANCE DATE 1/1/81.	12/21/78
III-7(Chng.)	Object Markers 3C-1, 3C-2	A type 3 object marker is a warning device and should conform to the standard color of black and yellow. A 5-year period for compliance is provided. COMPLIANCE DATE 2/9/88.	2/9/83
III-8(Chng.)	Simplified Pavement Marking Alphabet	A request to approve a simplified pavement marking alphabet was terminated as the requestor did not furnish requested data.	3/20/80
III-9(Chng.)	Uses and Spacing of Raised Pavement Markers	This adopted amendment of Sections 3A and 3B establishes standards for raised pavement markers (reflectorized and non-reflectorized) when used to supplement or in some cases to substitute for other types of pavement markings or as positioning guides.	7/22/85
III-10(Chng.)	Lane Drop Marking 3B-11	Adopts a special pavement marking pattern for use at lane drops. Use of this pattern is voluntary.	3/1/84
III-11(Intr.)	Dotted Line Extension at Entrance Ramps	The use of dotted lines through entrance ramps is not inconsistent with the MUTCD. A dotted extension of the right edgeline at entrance ramps is considered an acceptable practice.	7/12/81

Number	Title/Section	Ruling	Effective Date
III-14(Chng.)	Marking Bypass Lanes	A request to adopt standard marking patterns for bypass lanes was not approved for the following reasons: (1) the use of bypass lanes nationwide is not considered extensive enough to warrant a national standard; (2) bypass lanes have been used without special markings and without indicated operational problems; and (3) a bypass lane constructed to relatively high geometric standards would likely cost only slightly less than a design that would provide for a left turn lane.	2/9/83
III-15(Expr.)	No Passing Zone Advance Treatment	Approval was given to experiment with no-passing zone advance treatments.	5/21/79
III-16(Chng.)	Permissive Use of Wrong-Way Pavement Marking Arrows 2E-41, 3B-11	The requirement for the use of the Wrong-Way pavement arrow is changed to an advisory use.	2/9/83
III-17(Chng.	Standard Markings for Angle Parking Spaces	A request that standard marking patterns for angle parking be included in the MUTCD was not approved.	2/9/83
III-18(Chng.)	Mandatory Marking of Interchange Ramps 3B-11	Requires the use of channelizing lines and extension of the dashed lines for parallel deceleration lanes at exit ramps.	2/9/83
III-19(Chng.)	Delineator Post Design	Approval was given to experiment with delineator posts utilizing a variety of delineation configurations.	12/20/79
III-20(Chng.)	Pavement Markings for a Standard System of Highway Speed Control	A request to use various pavement marking pattern to indicate speed limits was not approved as being too complicated to implement and too confusing to drivers.	2/9/83

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Number	Title/Section	Ruling	Effective Date
III-21(Chng.)	Lateral Placement of Delineators 3D-5	Allows delineators to be placed an additional 2-feet outside the outer edge of the shoulder.	3/1/84
III-22(Chng.)	Pavement Markings for School Crossing	A request to adopt a proposed symbol as a standard for crossing pavement marking was not approved as it might be confused with other standard symbols and would neither reduce the time or material required for installation nor provide for long wear.	2/9/83
III-23(Chng.)	Mounting Height of Object Markers 3C-1	Provides more specific guidance on the placement of object markers.	3/1/84
III-24(Chng.)	Delineators on Truck Escape Ramps 3D-4	Establishes red for the color of delineators used to indicate the edge of truck escape ramps. A 5-year period for compliance is provided. COMPLIANCE DATE 3/1/89.	3/1/84
III-25(Chng.)	Marking of Pedestrian Curb Ramps	A request to adopt national standards regarding color and marking patterns for pedestrian curb ramps was not approved as they are not a traffic control device.	2/9/83
III-26(Chng.)	Delete Requirements for No-Passing Zone Markings	This request to change the MUTCD was not approved.	7/22/85
III-27(Chng.)	Skid Resistance of Marking Materials Section	This request to change the MUTCD was not approved. Pavement marking application procedures that will make highway agencies more cognizant of skidding problems associated with large painted areas should be included in the Traffic Control Devices Handbook rather than the MUTCD.	7/22/85
III-31(Expr.)	Narrower Pavement Marking Symbols	Experimentation was approved to evaluate the effectiveness of alternate designs for pavement marking symbols and letters. Experimentation and final report completed in June 1985. Alternative pavement marking symbols and letters will be included in "Standard Alphabets for Highway Signs and Pavement Markings."	6/6/84

Number	Title/Section	Ruling	Effective Date
III-32(Intr.)	Colored Pavement Surfaces/brick and Stone 3E-1, 3E-2	This request was for clarification on the use of brick and stone as colored pavement surfaces and whether or not they may be used as traffic control devices as discussed in Sections 3E-1 and 3E-2 of the MUTCD. Brick or Stone is considered to be a pavement surface. The use of brick or stone in its natural state does not constitute a colored pavement. However, should brick or stone be painted, stained, dyed, or other as to present the motorist with one of the three colors indicated in Section 3E-2, then they would be considered a colored pavement. A colored pavement is considered a traffic control device only if it is used to guide or regulate traffic or to supplement other traffic control devices.	10/12/84
III-36(Intr.)	Stop Lines at Mid-Block Crossings 3B-17	This request for interpretation concerns whether or not the use of stop lines is appropriate at a mid-block crossing where the motorist is not always required to stop. FHWA's response to this question was that stop lines can be used to supplement a mid-block crossing such as used at signalized intersections in advance of a crossing or as used at railroad grade crossings. In both situations the motorist does not always have to stop but is given further guidance by other traffic control devices. If the stop line is accompanied by the pavement word message "STOP" and the "STOP" sign, then every vehicle is required to stop at all times.	3/29/85
III-37(Intr.)	Crosswalk Pavement Marking Line Pattern 3B-18	Transverse crosswalk markings may be a nominal 12-inch wide line, consisting of two abutting rows of 6-inch square tiles with a 6-inch space between each tile in each row. The tiles of each row are offset so that an alternating or "checkerboard" pattern is provided.	6/14/85

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SIGNALS

Number	Title/Section	Ruling	Effective Date
*Sg-96(Chng.)	Pedestrian WALK Color 4D-4,7D-23	Deletion of the word "lunar" allowing the colors lunar white, clear white, to be used for the pedestrian WALK indication was approved.	2/9/83
*Sg-101(Chng.)	Pedestrian YIELD Sign on Signal	Request to change the MUTCD to introduce a yield sign or signal for pedestrians. This request was not approved for the following reasons: (1) no need for such a device has been identified from previous research; (2) no specific detailed device had been presented for consideration. (3) any such device would require changing existing laws in many States.	6/9/78
*Sg-102(Intr.)	Pedestrian Actuated Control 4C-12(2)	The intent of Section 4C-12(2) is that adequate pedestrian crossing time is needed during the green interval only when the pedestrian movement occurs. Since adequate crossing time is being provided (as a result of a push button activation to extend the green interval) the MUTCD requirements are being met.	5/18/78

* These requests were processed prior to issuance of the 1978 MUTCD and carry request numbers from 1971 Edition of the MUTCD.

Number	Title/Section	Ruling	Effective Date
*Sg-103(Intr.)	Marked Crosswalks 4D-4(5), 4D-5 4D-6	Request for clarification as to whether marked crosswalks are required whenever pedestrian signals are used. The sections in question refer to either marked or unmarked crosswalks and were not intended in themselves to be a mandate for marked crosswalks where pedestrian signals and detectors are used. Crosswalks are governed by Section 3B-15 which states that "crosswalks should be marked at all intersections where there is substantial conflict between vehicle and pedestrian movements."	7/27/78
*Sg-104(Chng.)	Pedestrian Indications at Tee-Intersections	A request to change from "shall" to "should" the requirement for a specific indication for pedestrians crossing from the top of the Tee toward the stem, was not approved as the request was not considered proper or reasonable in the safe control of traffic at signalized intersections.	2/9/83
*Sg-107(Intr.)	Arrow Left Turn Signals	Request on clarification of how an arrow signal face for left turns should be handled under flashing operation. FHWA response noted that the Manual: (1) precludes the darkening of a left-turn signal indications. (2) requires they be flashing CIRCULAR RED or CIRCULAR YELLOW; (3) does not provide for flashing arrow indications. Given these requirements such arrow signal faces must additionally provide for either a flashing CIRCULAR RED or flashing CIRCULAR YELLOW indication and could be handled by (1) a fourth indication (either CIRCULAR RED or CIRCULAR YELLOW); (2) effective substitution of the CIRCULAR RED and CIRCULAR YELLOW indications for the respective arrow indications.	5/24/78

*These requests were processed prior to issuance of the 1978 MUTCD and carry request numbers from 1971 Edition of the MUTCD.

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SIGNALS

Number	Title/Section	Ruling	Effective Date
IV-2 (Intr.)	Intersection Control Beacon 4B-6,4E-3	The MUTCD interpretation is twofold: (1) Where a route turns, the use of flashing red beacons on three approaches and the flashing yellow beacon on one approach, while not normally desirable, is not in conflict with the MUTCD; (2) the use of a steady green arrow in conjunction with flashing beacons is in conflict with Sections 4B-6 and 4B-16 of the MUTCD because there is potential for signalized conflict.	9/5/78
IV-3 (Expr.)	Blinking Signaling in Traffic Signals	The request was to code red and green traffic signal indications to apprise motorists and pedestrians of the time remaining before the light will change. The request was denied based on the possible hazardous condition that the proposed experimentation would create.	9/18/78
IV-4 (Chng.)	Noncontinuous Use of Emergency Signals 4B-19, 4E-21	The request to eliminate the requirement that emergency traffic signals be operated continuously and to allow them to remain "dark" during times that they are not activated for emergency purposes is denied. Drivers are conditioned not to expect "darkened" signals as required in Section 4B-19 so that adoption of this practice may pose accident hazards.	9/15/78

Number	Title/Section	Ruling	Effective Date
IV-5/Sg-100 (Chng.)	Use of Steady Flashing Downward Yellow Arrows 4E-8, 4E-9, 4E-10, 4E-12	Request to change the MUTCD to allow the use of steady and flashing downward YELLOW ARROW lane control signals on freeways to indicate that traffic conditions are congested but closure of the lane is not warranted. The request was denied but with the recommendation that it be resubmitted as a request for experimentation.	5/25/78
IV-5/Sg-100 (Expr.)	Use of Steady & Flashing Downward Yellow Arrows	The above request resubmitted as a request for experimentation and approved.	7/11/79
IV-7/Sg-11 (Intr.)	Conflicts Between Steady Red Traffic Signal Indications and Flashing Red Railroad Signals	Request as to whether there is a conflict between steady red traffic signal indications and flashing red railroad signals when the intersection and the railroad crossing are in close proximity. There is no conflict in the MUTCD.	7/2/81
IV-9/Sg-80 (Chng.)	Flashing Red Signals Facing the Median Crossover	A request to allow concurrent display of flashing and steady signal indications with a two-phase traffic signal at a wide median was not approved for the following reasons: (1) where a median is greater than 30 feet in width each roadway is considered a separate intersection for signalization purposes; and (2) degradation of the meaning of a CIRCULAR GREEN Signal indication.	2/9/83
IV-10/Sg-112 (Chng.)	Prohibit Straight Ahead Green Arrow	A request to prohibit the use of the straight ahead GREEN ARROW was not approved for the following reasons: (1) the straight ahead GREEN ARROW serves a purpose to many complex intersections; (2) the MUTCD does not allow indiscriminate use; and (3) prohibiting its use would unnecessarily limit flexibility of control devices.	2/9/83

Number	Title/Section	Ruling	Effective Date
IV-11/Sg-113 (Chng.)	Left Turn Lane Signal Displays for Permissive Left Turn	A request to preclude display of the circular green signal to control an exclusive turn lane during intervals when a circular green signal is displayed to oncoming traffic from the opposite direction was not approved as traffic capacity would be unnecessarily reduced.	2/9/83
IV-13(Chng.)	Dual Circular Indication Traffic Signals on Limited Use Roadways	A request to allow the use of a variable indication signal to display alternately a CIRCULAR GREEN and a CIRCULAR YELLOW indication on limited use roadways was not approved as it would degradate present standards which provide for uniform displays of signal indications to obtain positive response from all drivers.	2/9/83
IV-16(Intr.)	Signal Display for Exclusive Phase of Turn Signal	Request for an interpretation as to whether the simultaneous display of a CIRCULAR GREEN and a left-turn GREEN ARROW in the same signal head over an exclusive left turn lane is permissible at locations where permissive/protected left-turn phasing is used. The MUTCD allows permissive/protected left/turn phasing to display a CIRCULAR GREEN with a left-turn GREEN ARROW in the signal face that controls left-turn traffic regardless of the lateral position of the signal faces.	7/2/81
IV-17(Chng.)	Flashing Signal Display for Fire Preemption	A request to establish a uniform standard for priority control of traffic control signals for fire emergency vehicles not approved for the following reasons:: 1) the MUTCD provides was for priority control of traffic signals without unnecessarilylimiting the application of controls; 2) sufficient latitude to incorporate local concepts of priority control are presently allowed; 3) adoption of a uniform standard would unnecessarily limit flexibility of priority traffic control device uses.	2/9/83

Number	Title/Section	Ruling	Effective Date
IV-18(Chng.)	No Turn on Walk	A request to adopt a "No Turn on Walk" sign at signalized intersections where it is desired to prohibit right turn on red during a signal phase when pedestrians have completed use of the intersection was not approved as it was a duplication of the standard which requires vehicles to yield to pedestrians in a crosswalk.	2/9/83
IV-19/Sg-68b (Expr.)	Use of Strobe Lights at Railroad Crossings	A request to experiment with strobe-lights attached to cantilevered railroad crossing signals to improve conspicuity and reduce accidents at problem crossing was approved.	7/10/78
IV-20(Chng.)	Peak Hour Delay and Volume Warrants 4C-2, 4C-10	These 2 new warrants have been included in the MUTCD. This amendment provides greater latitude in evaluating the need for a signal installation.	12/31/84
IV-21(Chng.)	Required Locations of Traffic Signals 4B-8, 4B-13	A request permitting the alternative deployment of signals at intersections by providing for the use of 12-inch lenses in all signal installations between 120 and 150 feet beyond the stop line in lieu of an additional near-side signal was approved.	2/9/83
IV-22(Chng.)	Single Portable Traffic Light	A request to provide for use of a single face on a portable mounting for control of traffic through construction and maintenance zones was not approved as the need for two signal faces for each approach to a portable signal in construction and maintenance zones is as critical, if not more so, than it is at regular traffic signals.	2/9/83

Number	Title/Section	Ruling	Effective Date
IV-24(Expr.)	Signalization of an Isolated Industrial Driveway	A request to experiment with a traffic signal installation at an industrial driveway with high peak volumes intersecting a major traffic artery was approved.	9/4/80
IV-26(Expr.)	Evaluation of the Flashing Red Signal Ahead Sign and Flashing Red Strobe Signal	An experimental request to evaluate the effectiveness of the advance warning flashing "RED SIGNAL AHEAD" sign as well as a minor evaluation of the Red Strobe Signal was approved.	11/25/80
IV-27(Chng.)	Rules for Phasing and Sequencing of Traffic Signals 4B-6, 4B-9, 4B-12, 4B-15, 4B-16, 4B-22	Sections revised to provide well defined parameters and improved uniformity in the phasing and sequencing of traffic signals. Revision incorporates the results of a comprehensive review of Part 4B.	3/1/84
IV-29(Chng.)	Warrants for Freeway Entrance Ramp Control Signals 4E-23	Section revised to shift the terminology emphasis from "warrants" to "guidelines."	3/1/84
IV-30(Intr.)	Signal Operation Must Relate to Traffic Flow 4B-20	The word "shall" in Section 4B-20 is a mandatory requirement. The term "traffic requirements" relates to such factors as vehicular volumes, speeds, pedestrian volumes, etc. The Engineering data which should be updated and evaluated is the data needed to develop the new phasing and timing plan. The term "regularly" means a frequency based on engineering judgement, with which traffic characteristics change to the extent that new phasing and timing plans need to be considered.	5/5/81
IV-31(Chng.)	Periodic Darkening of Hazzard Identification Beacons	A request to modify Section 4B-19 to clarify guidelines for periodic darkening of Hazard Identification Beacons was was not approved as the present intent of this section is to preclude darkening of only traffic control signals.	2/9/83

Number	Title/Section	Ruling	Effective Date
IV-32(Chng.)	Flashing Operation of Newly Installed Traffic Signals	A request to provide for the flashing of a new traffic control signal during a period prior to stop and go operation was not approved as not an appropriate MUTCD requirement but considered good practice.	2/9/83
IV-33(Chng.)	Lane-Use Control Signals	Request withdrawn as it is an editorial change which cross-references two requirements of the MUTCD concerning the use of markings and overhead signals on reversible lanes (Sec. 3B-12, 4E-8).	2/9/83
IV-35(Intr.)	Pedestrian Clearance Interval Calculation	Request pertained to Section 4D-7 and whether or not the vehicle clearance interval following flashing DONT WALK can be considered as part of the pedestrian clearance interval, even though the DONT WALK is not flashing. The calculation of the amount of clearance interval (flashing DONT WALK) provided for pedestrians can consider the vehicle clearance interval as part of the time provided for pedestrian clearance even though the steady DONT WALK is displayed during the vehicle clearance interval. Discretion should be used in utilizing the latitude afforded by Section 4D-7.	7/23/81
IV-37(Expr.)	Flashing Yellow Permissive Turn Indication	A request to evaluate the use of protected/permitted (flashing YELLOW) left-turn phasing was approved. This experimentation substitutes a CIRCULAR GREEN with a flashing YELLOW display during the permitted portion of a left-turn phase in an exclusive left-turn signal.	6/21/82
IV-37a(Expr.)	Flashing Yellow Turn Indication	This request is a similar experimentation as IV-37 and was approved.	2/8/83

Number	Title/Section	Ruling	Effective Date
IV-41(Intr.)	Traffic Signal Display at Tee-Intersections	A request on the question of what is considered an appropriate display to meet the requirement of Section 4B-12(1) for an intersection approach which has a very predominate left-turn movement. The requirement for a minimum of two signal faces for the through traffic movement applies to what ever traffic movement is determined to be predominant. Thus, signal head displays should be selected to accommodate this predominate movement since the term "through movement" is not necessarily synonymous with "Straight Ahead" but could be interpreted to indicate there could be other types of through traffic, such as through turning left or right.	12/31/81
IV-42(Chng.)	Traffic Signal Design Configuration 4B-8, 4B-10, 4B-11, 4B-12	This adopted amendment provides minor changes in applications of 8-inch and 12-inch lenses, visibility and shielding of signal faces, number of signal faces and location of signal faces. The amendments are designed to provide greater uniformity and improve the performance of traffic signals. A 10-year compliance period is provided. Compliance Date 12/31/94.	12/31/84
IV-43(Chng.)	Four Hour Warrant for Traffic Signals 4C-10	This new warrant has been adopted for inclusion in the MUTCD.	12/31/84
IV-46(Intr.)	Simultaneous Display of Circular Red and Green Arrow	For protected/permitted left-turn phasing the simultaneous display of a CIRCULAR RED and GREEN ARROW on the same signal face is not only considered proper, but it is required that the signals in the left-turn lane display have a CIRCULAR RED indication when a CIRCULAR RED indication is displayed in the other two signal faces. This is required regardless of whether a GREEN ARROW, YELLOW ARROW, or no arrow is displayed on the signal. Confusion from such displays can be minimized by selecting display and installation arrangements that emphasize the shared function of such signals.	3/30/83

Number	Title/Section	Ruling	Effective Date
IV-54(Expr.)	Intersection Traffic Signal Strobe Light	A request to experiment with strobe-lights in conjunction with traffic signals to reduce accidents at a problem intersection was approved.	4/26/84
IV-57(Expr.)	Wireless Interconnection of Lane Use Control Signals 4E-12	A request was approved to experiment with a remote control system in lieu of electrical interconnection (as specified in section 4E-12) of lane control signals.	2/21/85
IV-63(Intr.)	Signal Sequencing Prior to Conflict Flash 4B-6	A steady yellow change indication, normally required per section 4B-6(7) of the MUTCD, is not required when a CIRCULAR GREEN or GREEN ARROW indication is terminated and is followed by a red flashing indication when this operation is triggered because a conflict has been deleted. The NEMA Conflict Monitor Standard and traffic signal controller does not provide for a change interval when flashing is triggered by the Conflict Monitor. Such provision would not be feasible in that it would complicate the operation of the system to such an extent that the reliability of this fail-safe provision would be reduced. Other considerations are, in the cases of conflicting green indications or the absence of RED, provisions for a change interval prior to display of flashing red for a minor approach,would prolong the conflict and the potential hazard. In any case, flashing operation in response to detection of a conflict, is an emergency operation and good judgement, reliability, and the functions available in standard equipment are the controlling factors.	11/21/84
IV-64(Intr.)	Mandatory Use of a Steady Left Green Arrow Indication 4B-6	A steady Left GREEN ARROW in accordance with Section 4B-6.5(f),shall be used as the green display on a signal face which controls an exclusive left-turn lane during intervals that the left-turn movement is protected by the signal sequence. Section 4B-6.4 lists types of locations where RED ARROW, YELLOW ARROW, and GREEN ARROW indications may be used but the more specific, mandatory requirement in section 4B-6.5(f) governs.	11/6/85

Number	Title/Section	Ruling	Effective Date
IV-65(Intr.)	Signal Warrants, Determining Numbers of Approach Lanes	Considerable engineering judgment must be exercised in applying various traffic signal warrants to cases where approaches consist of one lane plus one right- or one left-turn lane. The site specific traffic characteristics will dictate whether an approach should be considered as a one-lane approach or a two-lane approach. For example, for a minor street approach with one lane plus a left-turn lane, engineering judgment would indicate that it should be considered a one-lane approach if the traffic using the left-turn lane is minor. In such a case, judgment would also indicate that only the volume of traffic in the thru/right-turn lane should be considered against the warrants. Conversely, it would be considered as a two-lane approach if the lane split approached 50/50. A similar rationale could be applied to a minor street approach with one lane plus a right-turn lane. Judgment, in the case of right-turn lanes, must also be exercised relative to the degree of conflict of minor street right-turn traffic with traffic on the major street. Thus, right-turn traffic would not be included in the minor street volume if the movement operated as a merge, semi-merge or even, with typical intersection geometrics, entered the major street with a minimum of conflict. In such cases, the approach would be evaluated as a one-lane approach and only the traffic in the thru/left-turn lane considered.	10/28/85

Number	Title/Section	Ruling	Effective Date
IV-69(Intr.)	Pedestrian Signals at "T" Intersections 4C-12, 4D-3	The requestor questioned the need for the pedestrian indications, required under 4D-3.3, in suburban or rural locations with no pedestrian activity. The intent of Sections 4C-12 and 4D-3 of the MUTCD is clearly to provide some accommodations for pedestrians where they may be present, even if only occasionally. If there are no pedestrians crossing, then no provision for them would be required as long as that condition prevailed. The need for signal indications to be visible to pedestrians can be met by one of the following: (1) Vehicular indications for conflicting movements that can be conveniently viewed by pedestrians, provided the pedestrians can readily and accurately deduce when they have the right of way. In such cases, careful attention will also need to be given to pedestrian crossing times in accordance with Section 4C-12; (2) A RED, YELLOW, GREEN vehicle signal face visible to pedestrians; or (3) Where vehicular indications are not visible to pedestrians, provision of pedestrian signal indications as required (shall condition) in Section 4D-3.	10/31/85
IV-70(Expr.)	Michigan's Permissive/ Protected Left-Turn Phasing	A request to experiment with a flashing red circular indication to be used for the permissive portion of a permissive-protected left-turn phasing was approved.	8/20/85

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CONSTRUCTION AND MAINTENANCE

Number	Title/Section	Ruling	Effective Date
VI-2(Chng.)	Minimum Reflectivity Requirements	A request to specify Type III Sheeting as the minimum standard for the level of reflectivity of traffic control devices in work zones was not approved as the type of sheeting now commonly used (Type II) is satisfactory, less expensive, and there have been no reflectivity problems identified with its use.	2/9/83
VI-4(Chng.)	Shoulder Drop-Off Sign 6B-33	A symbol sign depicting a shoulder drop off was approved as an alternate to the word message sign (W8-9) LOW SHOULDER.	7/19/78
VI-5(Expr.)	Experimentation with Work Zone Traffic Control Devices	Approval was given to determine the effectiveness of selected barricades and channelizing devices and which elicits the most favorable driver response.	9/20/78
VI-6(Chng.)	Detour Design Criteria	A request to include design criteria for detours was not approved as appropriate for the MUTCD. Guidelines have been incorporated into the Traffic Control Devices Handbook.	2/9/83
VI-7(Chng.)	Maintained Visibility Level for Channelizing Devices	A request to require specific reflectorization or illumination of traffic control devices in work zones was not approved as being too subjective, difficult to measure and enforce.	2/9/83
VI-8(Chng.)	Orange Stop Ahead and Yield Ahead Symbol Signs	A request that these symbol signs, when installed in construction and maintenance areas, not have an orange background because of the poor contrast with red symbols, was not approved. Identifying the work area with the orange background is significantly important and the use of word legends is still acceptable.	2/9/83

Number	Title/Section	Ruling	Effective Date
VI-9(Chng.)	Prohibit Use of Metal Drums	A request that the use of metal drums be prohibited was not approved for the following reasons: (1) metal drums are used extensively without noted problems; (2) prohibition of the use of metal drums is a local option since the MUTCD does not mandate their use; and (3) there are many other devices available for use in lieu of metal drums.	2/9/83
VI-10(Chng.)	Use of Yellow Background Signs in Work Zones	A request to require work zone warning signs to have a yellow background was not approved for the following reasons: (1) when the color orange was adopted, it was recognized that the color contrast would not be as good; however the benefit to the motorist in being able to associate the color with work zones outweighed the poorer color contrast; and (2) where the black on orange contrast is considered to be a problem, a more highly reflective material may be used.	2/9/83
VI-11(Chng.)	Reflectorization of Signs 2A-18, 6B-2	A request requiring reflectorizing material, other than buttons or similar units, to have a smooth sealed outer surface was approved. A 5-year period for compliance is provided. COMPLIANCE DATE 2/9/88.	2/9/83
VI-12(Chng.)	Color of Reflectorized Material for Cones 6C-3	A change specifying white bands as the color of reflectorized material for cones and tubular markers. was approved. A 3-year period for compliance is provided. COMPLIANCE DATE 2/9/86.	2/9/83
VI-13(Chng.)	Advance Warning Flashing Arrow Panels 6E-7, 6E-8, 6E-9	Definition of the proper use of arrow panels and criteria for their use was approved. COMPLIANCE DATE 2/9/86.	2/9/83

Number	Title/Section	Ruling	Effective Date
VI-14(Chng.)	Two-Way Traffic on a Normally Divided Highway	This request to place additional guidance in the MUTCD regarding the type and kind of traffic control devices to be used when one roadway of a divided highway must be closed for Maintenance or reconstruction activities on the other roadway was not adopted. The FHWA has published guidance in the TCDH on which devices to use and how to use them.	7/22/85
VI-15(Chng.)	Use of Street Name Signs With Detour Signs 6B-38	Recommended use of Street Name signs with Detour signs was approved.	2/9/83
VI-16(Chng.)	Use of DETOUR ENDS Signs 6B-38	Recommended use of a DETOUR ENDS sign to provide improved guidance to motorists along detours was approved.	2/9/83
VI-17(Chng.)	Simulated Drums	A request to permit the use of simulated drums as an alternative to standard channelizing devices was not approved for the following reasons: (1) simulated drums are a nonstandard version of a vertical panel; (2) a sufficient variety of devices for channelizing in work zones are already permitted; and (3) simulated drums do not look as formidable as drums and, persumably would not be as effective.	3/1/84
VI-18(Chng.)	Standards for Flashing and Steady Burn Warning Lights 6E-5	Provides that new flashing and steady burn warning lights are obtained based upon a purchase specification, and that existing devices perform based upon a field performance specification using distance and visibility criteria.	3/1/84
VI-19(Intr.)	Use of 30-Gallon Drums	The height requirement of "approximately" 36 inches for drums set on end and used for traffic warning or channelizing in construction and maintenance work areas does not permit the use of 30-gallon drums as traffic control devices.	7/2/81

Number	Title/Section	Ruling	Effective Date
VI-20(Chng.)	Delete Use of Hand Signaling Flags 6F-2, 6F-4	This amendment adopts the sign paddle as the primary hand signaling device to control traffic through work areas except in unusual situations. The use of hand signaling flags is limited to emergency and single flagger situations only. A 3-year period for compliance is provided. Compliance Date 12/31/87.	12/31/84
VI-23(Chng.)	Color of Barricade Supports 6C-8	This amendment deletes the color requirements for barricade supports (the components other than the rails).	12/31/84
VI-25(Chng.)	Use of 28-Inch Cones 6C-3	This amendment adopts a minimum height of 28 inches for cones used on freeways and other high speed roadways, whenever more conspicuous guidance is needed and for all facilities during hours of darkness.	12/31/84
VI-26(Chng.)	Detour Signing 6B-8, 6B-9	This amendment adopts more flexibility in determining the types of projects and types of roadways where detour signing should be used.	12/31/84
VI-28(Chng.)	Identification of Channelizing Devices 6C-8	This section is amended to allow owner identification on the face of nonreflectorized barricade members.	12/31/84
VI-30(Chng.)	Two-Lane, Two-Way Operation on One Roadway of a Normally Divided Highway Figure 6-8, 6C-1	This amendment adds language to Figure 6-8 to reflect recommended practice that two-way traffic in the detour area be physically separated by traffic control devices under normal conditions. Also, section 6C-1 is being revised to direct attention to this and other typical applications of channelizing devices.	12/31/84

Number	Title/Section	Ruling	Effective Date
VI-31(Intr.)	Stop Control at Spot Intersections 6F-6	C.E. Maguire, Inc. of New Britain, CT requested an interpretation of Section 6F-6. They have used a stop control at both ends of a work zone for a one-way traffic control on bridge projects of relatively short length, long duration, good sight distance and moderate to low traffic volumes. The second sentence of Section 6F-6 states that at a "spot" obstruction, such as an isolated pavement patch, the movements may be self-regulating. The FHWA's interpretation is that for the conditions described, one-way traffic control using a self-regulating control system is in keeping with the intent of Section 6F-6.	6/27/84

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RAILROAD-HIGHWAY GRADE CROSSINGS

Number	Title/Section	Ruling	Effective Date
VIII-1(Chng.)	Lateral Clearance for Flashing Lights Signals and Gates	A request to establish greater lateral clearance for railroad crossing signal supports was not approved as it would: (1) require an increase in length of gate arms; (2) increase the need for cantilever gate arms or the potential for train/vehicle collisions; and (3) require increased maintenance effort for alignment of flashing light signals.	2/9/83
VIII-2(Chng.)	Warning Signs on Roads Parallel to Railroads 8B-3	The addition of standard signs for warning motorists on roads parallel to railroads was approved. A 5-year compliance period is provided. COMPLIANCE DATE 2/9/88.	2/9/83
VIII-4(Chng.)	Railroad Advance Warning Sign Depicting Angle of Crossing	A request to adopt a railroad advance warning sign depicting the angle of crossing was terminated as the requester did not furnish requested data.	5/29/83
VIII-5(Chng.)	Use of STOP signs at Railroad-Highway Grade Crossings 2B-5, 8B-9	A change providing for the use of STOP signs at railroad-highway grade crossings, only where the need for the signs has been determined by a detailed traffic engineering study was approved.	2/9/83
VIII-6(Chng.)	Details on Railroad Bells	A request to include specifications for the use of bells at railroad-highway grade crossings was not approved as it is not appropriate for inclusion in the MUTCD.	2/9/83
VIII-7(Chng.)	Required Use of Crossbucks on Bikeways	A request to require at least one crossbuck sign on approach to a grade crossing was not approved as such each bikeway installation should be determined by engineering judgement and not required.	2/9/83

Number	Title/Section	Ruling	Effective Date
VIII-9(Chng.)	Elevation of Top of Foundation for Flashing Lights and Gates	A request to delete the requirement that the top of the foundation for flashing light signal and gate supports be at the same elevation as the crown of the roadway was not approved as the benefits achieved from standardizing support post lengths outweigh the potential benefits of eliminating the elevation requirement.	2/9/83
VIII-13(Expr.)	Active Advance Warning Devices	Approval was given to experiment with active advance warning devices at several railroad-highway grade crossings in Michigan as part of an FHWA sponsored research contract.	7/6/84
VIII-15(Expr.)	Active Warning Devices	Approval was given to experiment with modified active warning devices at several crossings in Tennessee as part of an FHWA sponsored research project.	7/6/84

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BICYCLE FACILITIES

Number	Title/Section	Ruling	Effective Date
IX-1(Chng.)	Symbol Sign for Interstate Bike Routes 9B-21	A route marker was approved for use on bicycle routes that extend for long distances in two or more States.	7/26/78
IX-2(Chng.)	Bike Parking Sign 9B-23	A standard sign to designate bicycle parking areas was approved.	2/9/83
IX-3(Chng.)	Hostel Sign	A symbol sign closely resembling the Camping/Picnicking sign to provide guidance to hostels was not approved for use as a national standard. Sign was reconsidered and not approved for the following reasons: (1) there is little demonstrated need for such signals; (2) other means are available to get such information to bicyclists and other non-motorists; and (3) similarity with the picnicking sign could create confusion.	9/12/78 2/9/83